PB87-188405

Superfund Record of Decision (EPA Region 4)
A. L. Taylor Site (Valley of the Drums)
Bullitt County, Kentucky, June 1986

(U.S.) Environmental Protection Agency
Washington, DC

4 Sep 86

U.S. Department of Commerce
National Technical Information Service
NTIS

United States
Environmental Protection
Agency

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Emergency and
Remedial Response

EPA/ROD/R04-86/009
June 1986

PB87-188405

EPA

Superfund Record of Decision:

A. L. Taylor, KY

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16. ABSTRACT

The A. L. Taylor site, also known as "Valley of the Drums", is located in a small valley in northern Bullett County outside of Brooks, Kentucky. This site was first identified as a waste disposal site by the Kentucky Department of National Resources and Environmental Protection (KDNREP) in 1967. The owner, Mr. Taylor, excavated pits on site and emptied the contents of the drums into them and recycled the drums. Soil from nearby hillsides was eventually used to cover the pits. Thousands of drums were also stored on the surface. Mr. Taylor never applied for the required State permits throughout this history of site operations from 1967 to 1977. The KDNREP first documented releases of hazardous substances in 1975. They pursued legal actions against Mr. Taylor until his death in late 1977. In January 1979 the EPA responded to releases of oil and hazardous substances at the site. In 1980 the KDNREP contacted six responsible parties who identified and removed approximately 30% of the waste remaining on the surface of the site. In 1981 the EPA, upon inspection, discovered deteriorating and leaking drums and discharges of pollutants into the nearby creek. EPA conducted a removal action to upgrade the existing treatment system and remove the remaining 4,200 drums of surface waste offsite for recycling or disposure. There remains an unknown amount of waste buried onsite. The hazardous substances detected at this site include approximately 140 compounds of the following classes:
(See Attached Sheet)

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Record of Decision A. L. Taylor, KY Contaminated Media: sw, gw, sediments Key contaminants: Heavy metals, inorganics, PCBs, organics, VOCs, PAHs, Toluene, PCE, vinyl chloride, xylene		

18. DISTRIBUTION STATEMENT

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EPA/ROD/R04-86/009
A. L. Taylor, KY

16. ABSTRACT (continued)

heavy metals, ketones, phthalates, polychlorinated biphenyls, PCBs, chlorinated alkanes and alkanes, aromatics, chlorinated aromatics, and polynuclear aromatics (PAHs).

The selected remedial action for this site includes: removal of pond water; securing pond sediments, sludge and materials from low-lying areas beneath the cap; installing a final cap cover for containment of the waste materials; constructing a surface water drainage diversion to re-route surface water; implementing a performance monitoring program to evaluate the effectiveness or the clay cap to mitigate surface chemical migration. The capital cost for the selected remedial alternative is estimated to be $795,349. O&M costs for this selected remedy were not specified. The Commonwealth of Kentucky will assume the O&M costs one year after the completion of construction.

RECORD OF DECISION

REMEDIAL ALTERNATIVE SELECTION

Site: A. L. Taylor Site (Valley of the Drums), Bullitt County, Kentucky

Documents Reviewed

I am basing my decision primarily on the following documents describing the analysis of cost and effectiveness of remedial alternatives for the A. L. Taylor Site.

Conestoga-Rovers and Associates Limited, 1986 Preliminary Remedial Construction Design, A.L. Taylor Site, Bullitt County, Kentucky.

Metcalf and Eddy, Inc., 1984, Feasibility Study Addendum and Endangerment Assessment of the A. L. Taylor Site, Brooks, Kentucky.

Geosciences Research Associates, Inc., 1984, Hydrologic Investigation of the A. L. Taylor Site, Bullitt County, Kentucky.

Geosciences Research Associates, Inc., 1983, Technical Proposal for Soil and Groundwater Testing and Permeability Determination.at A. L. Taylor Landfill Site, Bullitt County, Kentucky.

NUS Corporation, 1983, Sampling Investigation Report, A. L. Taylor Site, Brooks, Kentucky.

Metcalf and Eddy, Inc., 1983, Review of Data and Proposed Remedial Alternative for one A. L. Taylor Site, Brooks, Kentucky.

Geosciences Research Associates, Inc., 1983, A. L. Taylor Site Onsite Containment Plan.

Tenech Environmental Engineers, Inc., 1983, Final Design Report for Remedial Action of the A. L. Taylor Hazardous Waste Disposal Site.

Ecology and Environment, Inc., 1982, Feasibility Study of Remedial Alternatives for the A. L. Taylor Site, Task Report to the EPA.

Ecology and Environment, Inc., 1982, Remedial Action Site Investigation, A. L. Taylor Site, Brooks, Kentucky. Task Report to the EPA.

U.S. EPA, 1982, Historical Analysis A. L. Taylor Site, Brooks, Kentucky. Environmental Monitoring System Laboratory Environmental Photographic Interpretation Center, Warrenton, Virginia.

Ecology and Environment, Inc., 1982, A. L. Taylor Site Deep Test Boring, Letter Report.

Ecology and Environment, Inc., 1981, Geologic Investigation at A. L. Taylor Site, Letter Report to Richard D. Stonebraker.

Technos, Inc., 1981, Subsurface Investigation of the A. L. Taylor Hazardous Material Site, Bullitt County, Kentucky, Report to Ecology and Environmental Inc. and U.S. EPA.

Tenech Environmental Engineers, Inc., 1983, Contract Documents for Remedial Actions at the A. L. Taylor Hazardous Waste Disposal Site.

Tenech Environmental Engineers, Inc., 1983, Remedial Actions for the A. L. Taylor Hazardous Waste Disposal Site.

U.S. EPA, 1980, Valley of the Drums, Bullitt County, Kentucky, Oil and Special Materials Control Division, Washington, D.C.

U.S. EPA, 1979, Valley of the Drums, Shepherdsville, Kentucky, Environmental Response Team, Edison, New Jersey.

U.S. EPA, 1979, Soil Coring Study, A. L. Taylor Hazardous Waste Site, Bullitt County, Kentucky, Region IV Surveillance and Analysis Division, Athens, Georgia.

U.S. EPA, 1979, Environmental Monitoring Activities Associated with Hazardous Waste Storage Sites; Louisville, Kentucky, Region IV Surveillance and Analysis Division, Athens, Georgia.

U.S.G.S., 1960, Availability of Groundwater in Bullitt, Jefferson and Oldhall Counties, Kentucky.

Staff Summaries and Recommendations are atttached.

Description of Selected Remedy

The selected remedy includes:

- Remove surface water from the site.
- Secure pond sediments, sludge and materials from low-lying areas beneath the cap.
- Install final cap cover for containment of the waste materials.
- Construct a surface water drainage diversion which will route surface water around the cap area and which can accommodate a 25 year/24 hour storm.
- Implement a performance monitoring program on Wilson Creek (the only potential receptor of chemical migration) to evaluate the effectiveness of the clay cap insuring mitigation of surface chemical migration.
- Following the completion of the remedial construction the site will be secured with the installation of a six foot high chain link fence with appropriate gates.
- The site will be subject to a regular inspection and maintenance program following completion of remedial construction for a period of thirty (30) years.
- The active contaminant migration pathway at the A. L. Taylor site is by surface water runoff. The final cover is proposed as a method of containing waste materials and preventing contact between surface water and waste.
- Based on the cost-effective criteria of Section 300.68 (j) of the National Contingency Plan, evaluation of the remedial alternatives and the endangerment assessment, EPA recommends that the onsite containment alternative as proposed in the conceptual design submitted by the potentially responsible parties be implemented at this site.

DECLARATIONS

Consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), and the National Contingency Plan (40 CFR Part 300), I have determined that the on site containment alternative is a cost effective remedy and provides adequate protection of public health, welfare and the environment. The Commonwealth of Kentucky has been consulted and agrees with the approved remedy.

In addition, the action will require future O & M activities to ensure the continued effectiveness of the remedy. These activities will be considered part of the approved actions and eligible for Trust Fund monies for a period not to exceed 1 year.

I have also determined that the action being taken is appropriate when balanced against the availability of Trust Fund monies for use at other sites.

JUN 18 1986

Date

Jack E. Ravan

Jack E. Ravan
Regional Administrator

Record of Decision
Remedial Alternative Selection
A. L. Taylor Site
Brooks, Kentucky

SITE LOCATION AND DESCRIPTION

The A. L. Taylor site, also known as "Valley of the Drums", is an uncontrolled industrial waste dump located in a small valley in northern Bullitt County just south of the Jefferson County line off Kentucky State Highway 1020 outside the community of Brooks, Kentucky (see figure 1).

The topography of the north-central portion of Bullitt County is characterized by steep slopes, particularly in that portion of the county bordering Jefferson County. The A. L. Taylor site falls within this general characterization having 20 to 30 percent slopes on the western and northern sides of the site and 10 percent on the southern and eastern sides. The site is not within any 100 year flood plain. Most of the surface area of the site has been graded so that the land gradually slopes eastward toward Wilson Creek, located adjacent to the site. There are five residences and a private country club located within a few thousand feet of the site.

Groundwater at the site occurs in two aquifers: a shallow unconfined perched aquifer and a deeper confined limestone aquifer. Groundwater monitoring wells drilled on site in both water-bearing units show that both are unusable as drinking water supplies due to poor quality and low yield. Local populations around the site use cisterns and public water supplies.

Wilson Creek, located adjacent to the site, is a small stream subject to seasonal low flow conditions. The stream lies within the Salt River drainage basin and is classified for recreational use.

SITE HISTORY

The A.L. Taylor site was first identifed as a waste disposal site by the Kentucky Department of Natural Resources and Environmental Protection (KDNREP) in 1967. The actual disposal site covers 13 acres of the 23-acre tract owned by Mr. Taylor. The surface features of the site have been substantially disturbed. Mr. Taylor excavated pits on site and emptied the contents of the drums into them and recycled the drums. Soil from nearby hillsides was eventually used to cover the pits after the KDNREP stopped Mr. Taylor from burning solvents. Thousands of drums were also stored on the surface, especially during later years of operations. During the remedial investigation, four or five major cells of buried wastes containing chemical liquids, sludges and crushed drums were identified.

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Throughout the history of site operations from 1967 to 1977 Mr. Taylor never applied for the required state permits. The KDNREP first documented releases of hazardous substances from the site in 1975. They pursued legal actions against Mr. Taylor until his death in late 1977.

In January 1979, at the request of the KDNREP EPA responded to releases of oil and hazardous substances at the A. L. Taylor site. Under the authority of Section 311 of the Clean Water Act, the EPA Emergency Response Branch On-Scene Coordinator prevented further releases of pollutants into nearby Wilson Creek by constructing interceptor trenches and a temporary water treatment system, securing leaking drums, and segregating and organizing drums on site.

In 1980 the KDNREP contacted six responsible parties who identified and removed approximately 30 percent of the waste remaining on the surface of the site. Following this removal an estimated 4,200 drums remained.

In 1981 EPA again inspected the site and discovered deteriorating and leaking drums and discharges of pollutants into Wilson Creek occurring once again. EPA, responding under the emergency provisions of CERCLA, upgraded the existing treatment system and removed the remaining 4,200 drums of surface wastes off site for recycling or disposal. There remains, however, an unknown amount of waste buried on site.

CURRENT SITE STATUS

The paints and coatings industries of the Louisville area were the primary waste generators using the A. L. Taylor site. Some of the drums were emptied into open pits, cleaned and recycled. Other drums were buried on site, and during the later years of operation many drums were stored on the surface. The open pits which were once used for burning solvents had been covered over prior to EPA's involvement.

The initial drum inventory conducted in 1979 showed 17,051 drums on the surface and of those, 11,628 were empty. During the 1979 emergency response, several disposal pits were discovered. Over the next three years several investigations were conducted to define those disposal pits, including exploratory test pits and the use of geophysics (see Figure 2). An estimated volume of material and number of drums in each disposal pit is given in Figure 3.

Analytical data has been collected during several site actions including the two immediate removals and the remedial investigation. Hazardous substances detected on site include the following classes of compounds: heavy metals, ketones, phthalates, polychlorinated biphenyls (PCB), chlorinated alkanes and alkenes, aromatics, chlorinated aromatics, and polynuclear aromatics. In all,

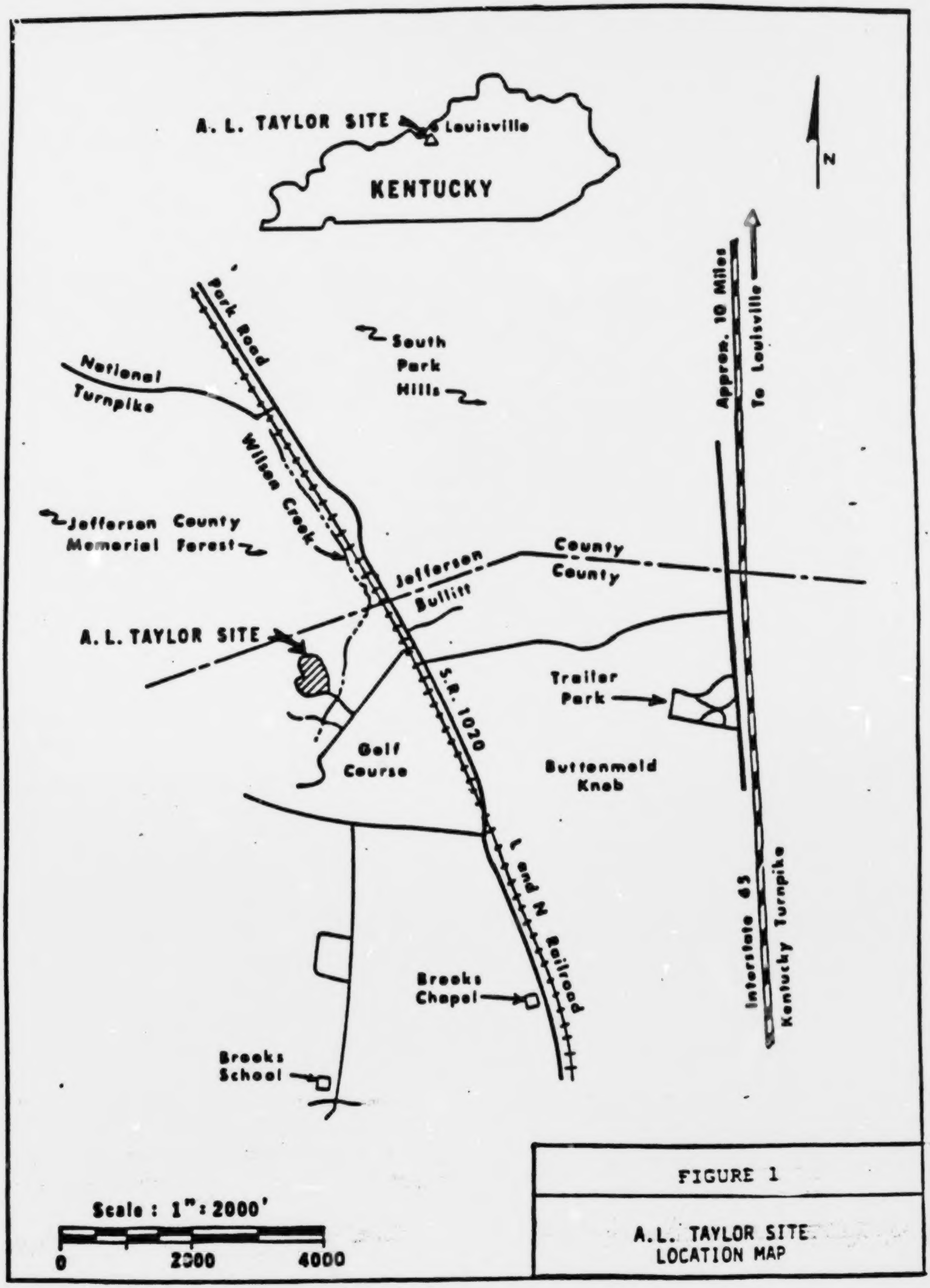

FIGURE 1

A.L. TAYLOR SITE
LOCATION MAP

Reproduced from best available copy.

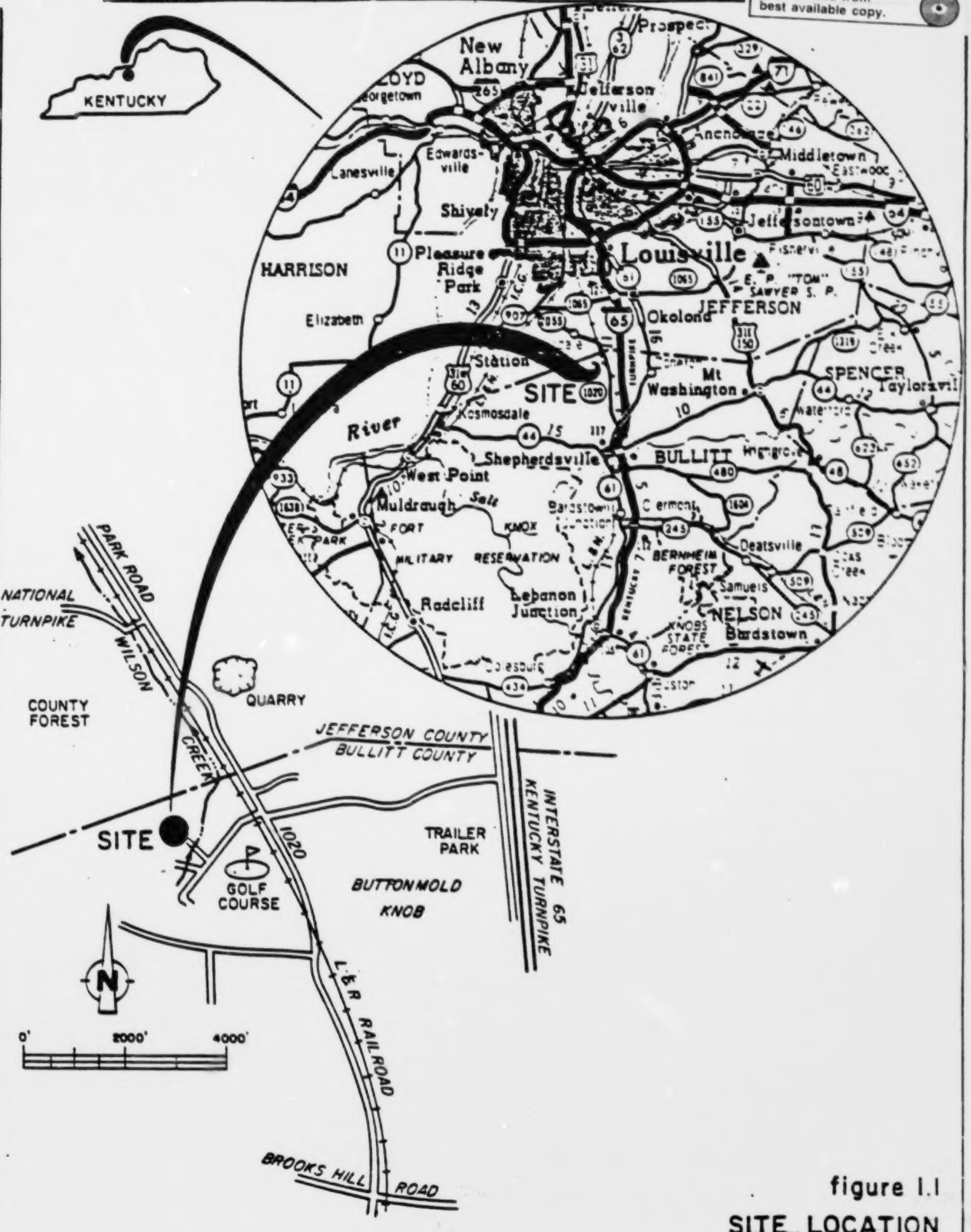

figure 1.1

SITE LOCATION
A.L. TAYLOR SITE
Bullitt County, Kentucky

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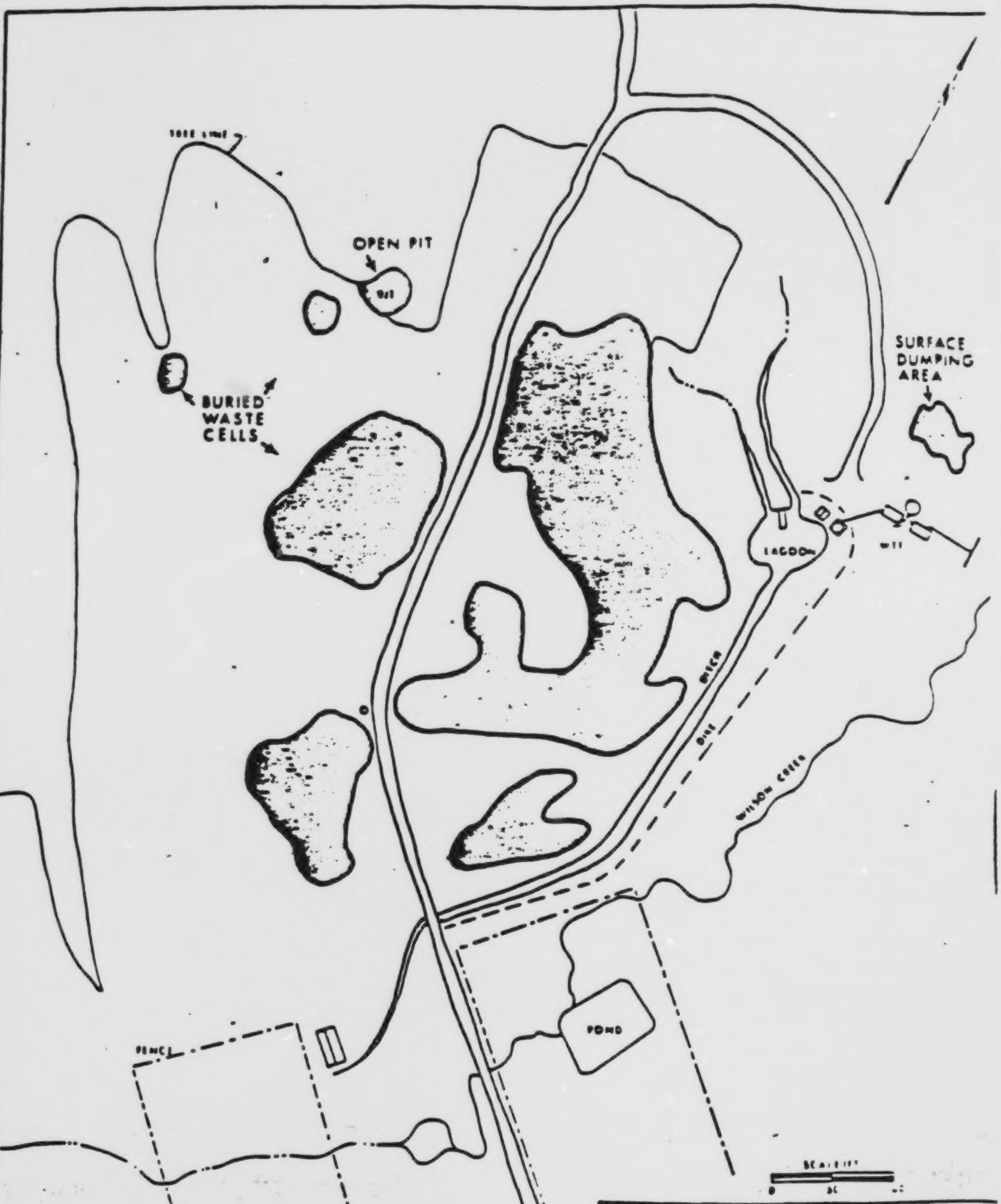

FIGURE 2

BURIED WASTE CELLS, OPEN PIT, &
SURFACE DUMPING AREA

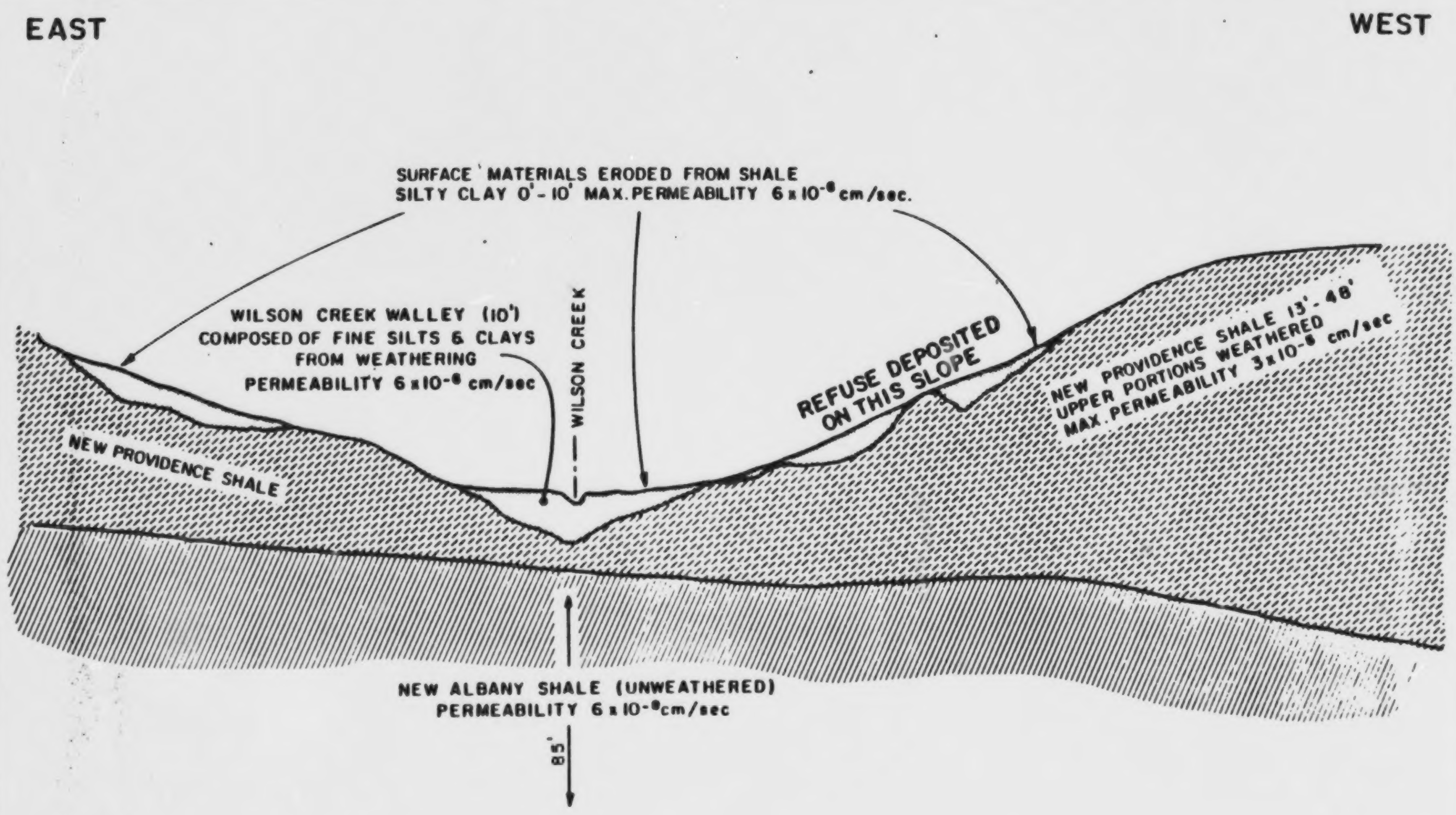
EAST
WEST
SURFACE MATERIALS ERODED FROM SHALE
SILTY CLAY 0'-10' MAX. PERMEABILITY 6 x 10-8 cm/sec.
WILSON CREEK WALLEY (10')
COMPOSED OF FINE SILTS & CLAYS
FROM WEATHERING
PERMEABILITY 6 x 10-8 cm/sec
WILSON CREEK
REFUSE DEPOSITED ON THIS SLOPE
NEW PROVIDENCE SHALE 13'-48'
UPPER PORTIONS WEATHERED
MAX. PERMEABILITY 3 x 10-8 cm/sec
NEW PROVIDENCE SHALE
NEW ALBANY SHALE (UNWEATHERED)
PERMEABILITY 6 x 10-8 cm/sec
85'

figure 2.1

SCHEMATIC OF
ORIGINAL VALLEY AND CURRENT GEOLOGY
Bullitt County, Kentucky

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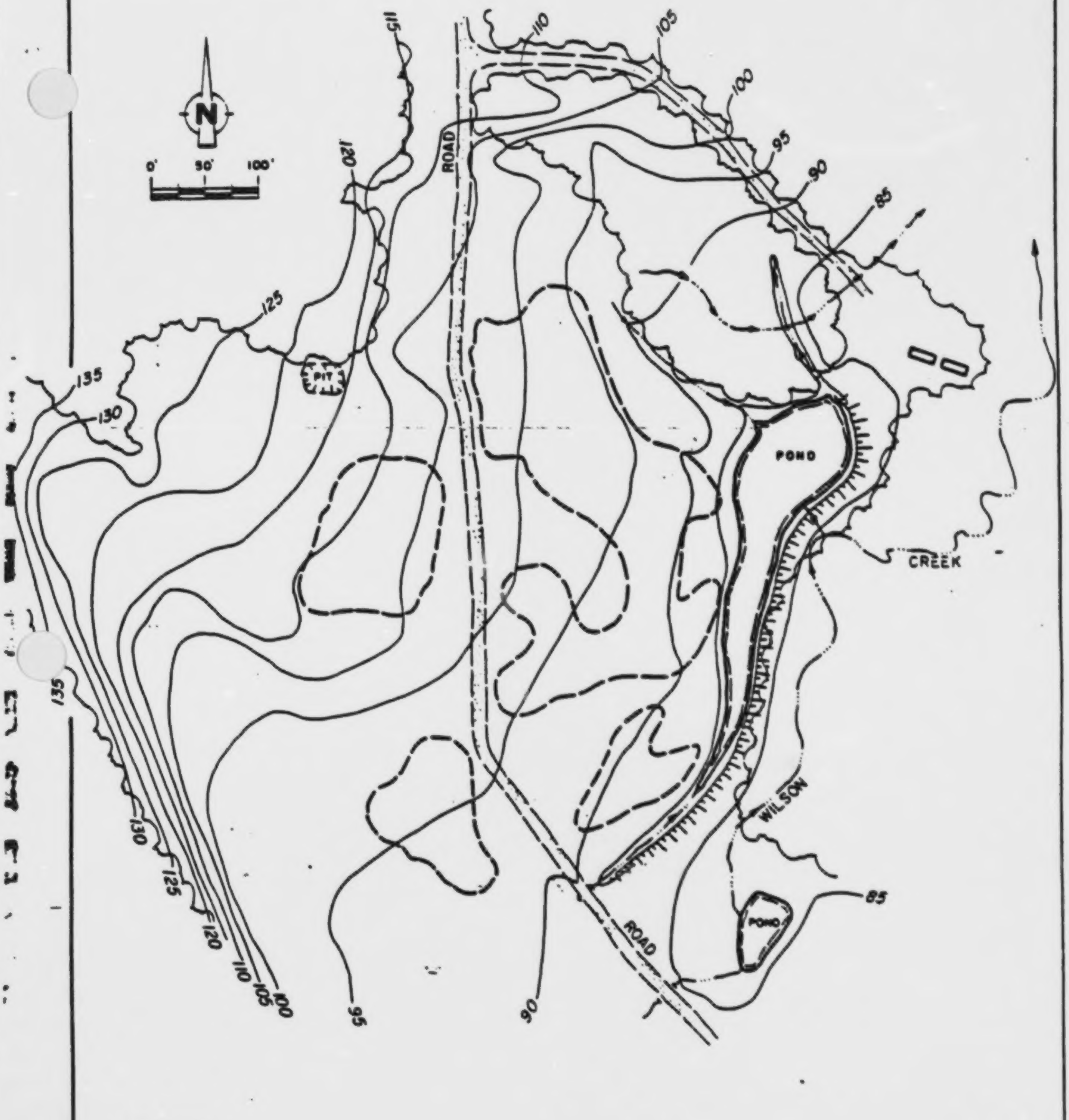


LEGEND

— — — SUSPECTED WASTE DISPOSAL AREA

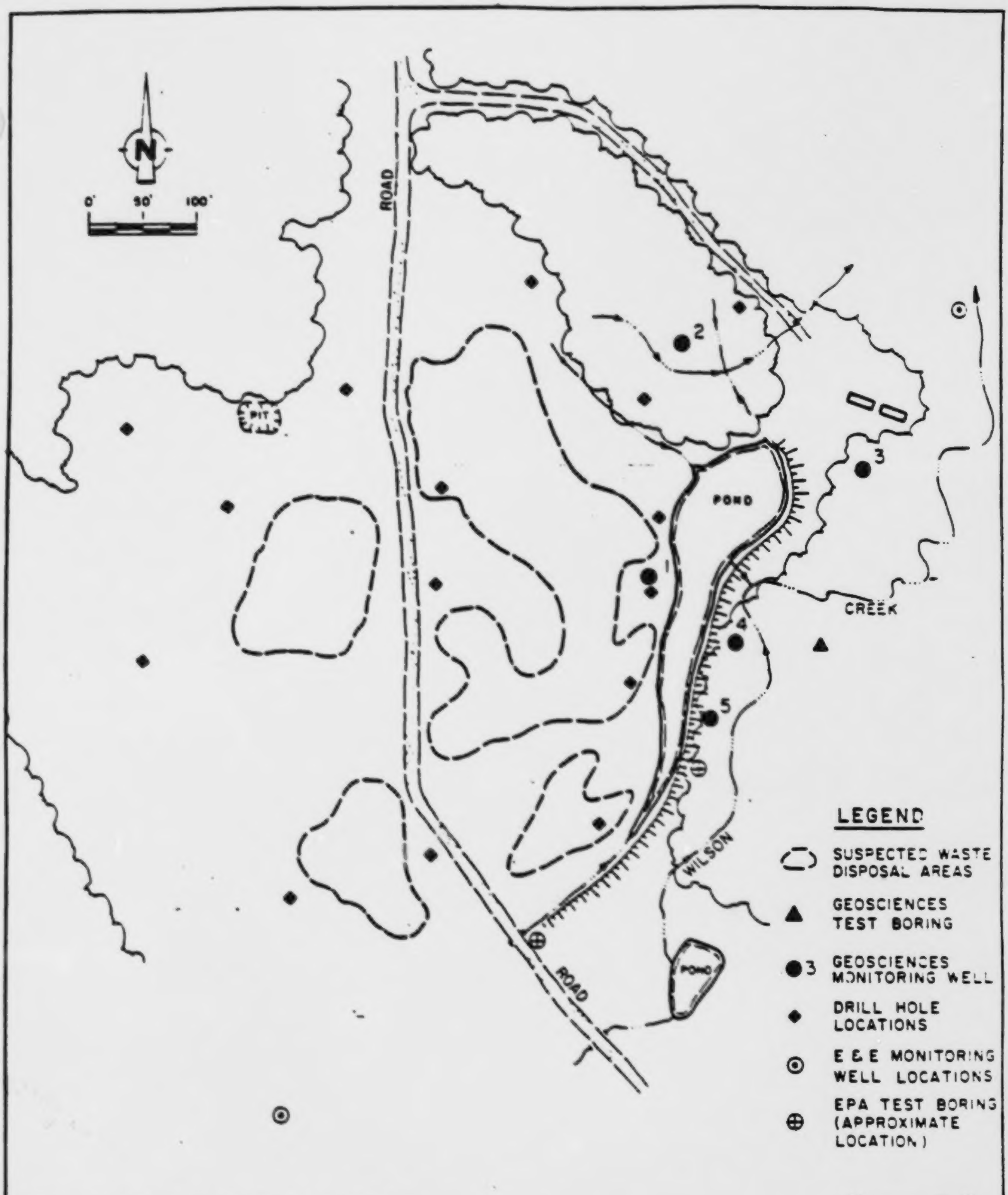
110——— TOPOGRAPHIC CONTOURS

MAP MODIFIED FROM TENECH,
SEPTEMBER 1983, FINAL DESIGN REPORT

CRA

figure 2.2
SITE MAP
A.L. TAYLOR SITE
Bullitt County, Kentucky

1718 - 20/11/85


N
0'
50'
100'
ROAD
PIT
2
POND
3
1
4
CREEK
5
WILSON
ROAD
POND
LEGEND
SUSPECTED WASTE DISPOSAL AREAS
▲ GEOSCIENCES TEST BORING
●3 GEOSCIENCES MONITORING WELL
◆ DRILL HOLE LOCATIONS
⊙ E & E MONITORING WELL LOCATIONS
⊕ EPA TEST BORING (APPROXIMATE LOCATION)

NOTE REFERENCE TAKEN FROM FIGURE 1 - MAP OF TAYLOR SITE SHOWING LOCATIONS OF TEST BORINGS AND MONITORING WELLS.

MAP MODIFIED FROM TENECH, SEPTEMBER 1983, FINAL DESIGN REPORT

figure 2.3

EXISTING TEST BORING AND MONITORING WELL LOCATIONS
A.L. TAYLOR SITE
Bullitt County, Kentucky

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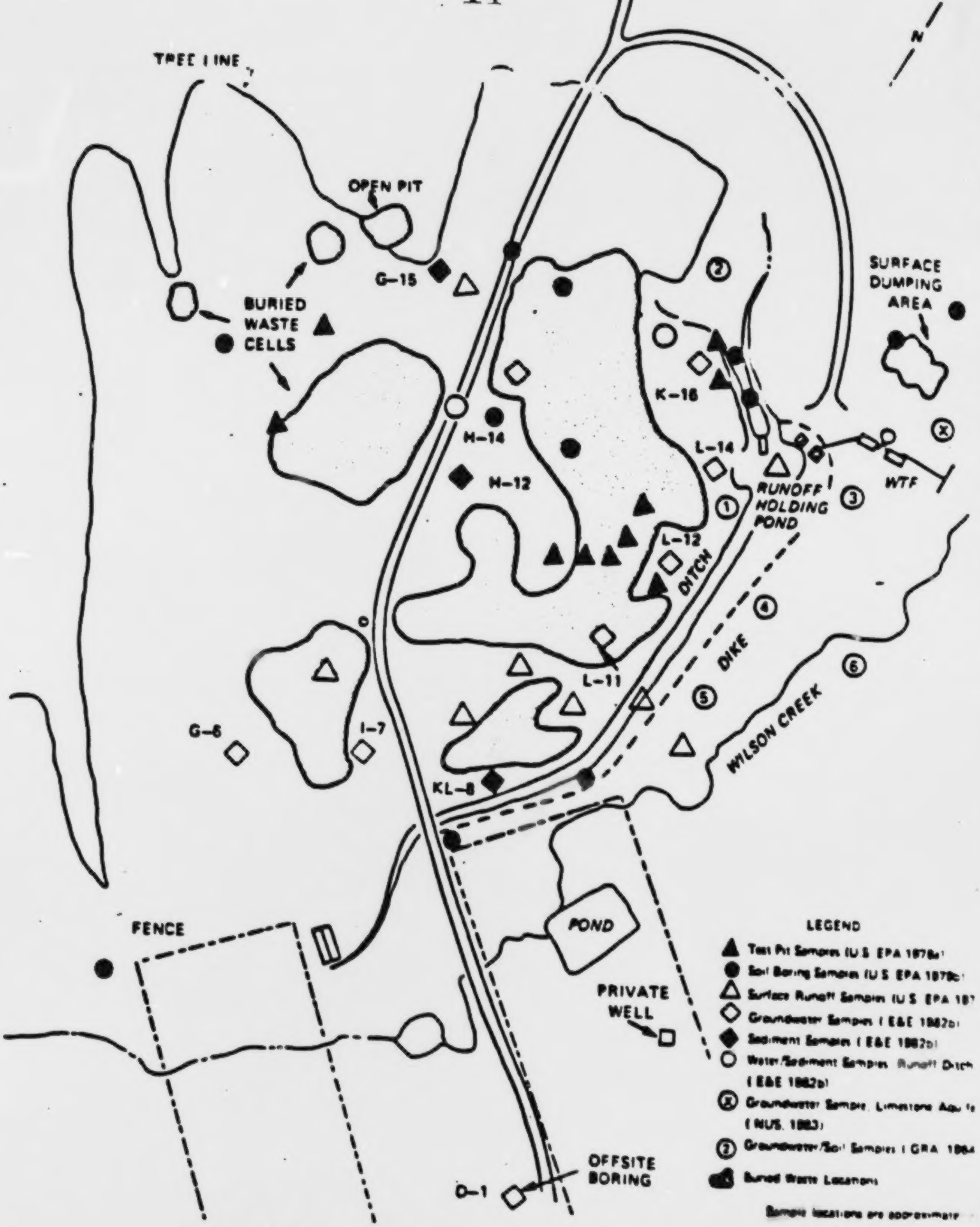
FIGURE 3

ESTIMATED QUANTITY OF BURIED WASTES AT THE A. L. TAYLOR SITE BROOKS, KENTUCKY

LOCATION	VOLUME OF MATERIAL (in cubic feet)		NUMBER OF DRUMS (uncrushed)	
	Minimum[1]	Maximum[2]	Minimum[3]	Maximum[4,5]
Trench 1	78,875	147,125	2155	8040
Trench 2	40,875	66,625	1117	3641
Trench 3	13,750	25,500	376	1393
Trench 4	38,000	63,750	1038	3484
Trench 5	21,812	36,312	596	1984
Totals	193,312	339,312	5282	18,542

NOTES:

1. Calculated using major anomaly area times 5 feet thickness plus significant anomaly area times 2 feet thickness.
2. Calculated using major anomaly area times 10 feet thickness plus significant anomaly area times 2 feet thickness.
3. Calculated using density of one drum per 36.6 cubic feet and minimum volume.
4. Calculated using density of one drum per 18.3 cubic feet and maximum volume.
5. If drums are crushed, the estimated number may increase from two to five times the number of drums given.
6. The values given are order of magnitude estimates only. Area locations are indicated in Figure 1-2. One 55-gallon drum occupies about 9.15 cubic feet. Estimates calculated assume that the drums were randomly dumped, yielding densities ranging from 18.3 to 36.6 cubic feet/drum.


N
TREE LINE
OPEN PIT
BURIED WASTE CELLS
G-15
SURFACE DUMPING AREA
K-16
H-14
H-12
L-14
RUNOFF HOLDING POND
WTF
L-12
DITCH
DIKE
L-11
WILSON CREEK
G-6
I-7
KL-8
FENCE
POND
PRIVATE WELL
OFFSITE BORING
D-1
LEGEND
Test Pit Samples (U.S. EPA 1978a)
Soil Boring Samples (U.S. EPA 1978c)
Surface Runoff Samples (U.S. EPA 197
Groundwater Samples (E&E 1982b)
Sediment Samples (E&E 1982b)
Water/Sediment Samples, Runoff Ditch (E&E 1982b)
Groundwater Sample, Limestone Aqu
(NUS, 1983)
Groundwater/Soil Samples (GRA 1984
Buried Waste Locations
Sample locations are approximate

SAMPLING LOCATIONS AND SUSPECTED WASTE DISPOSAL AREAS (SHADED AREAS)

METCALF & EDDY

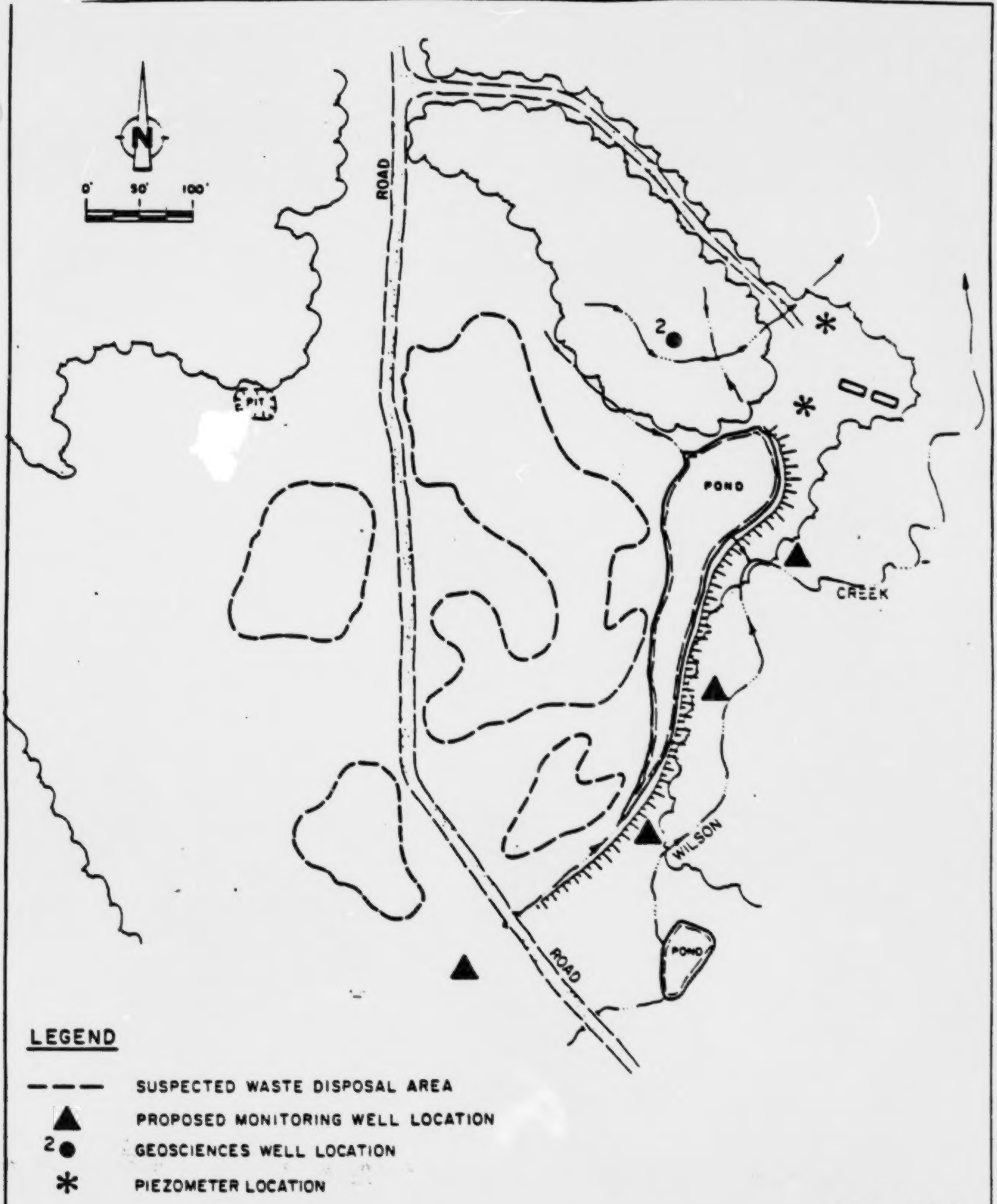

N
0'
50'
100'
ROAD
PIT
2
POND
CREEK
WILSON
ROAD
POND
LEGEND
SUSPECTED WASTE DISPOSAL AREA
PROPOSED MONITORING WELL LOCATION
2 GEOSCIENCES WELL LOCATION
PIEZOMETER LOCATION

figure 3.2

PROPOSED MONITORING WELL LOCATIONS
A.L. TAYLOR SITE
Bullitt County, Kentucky

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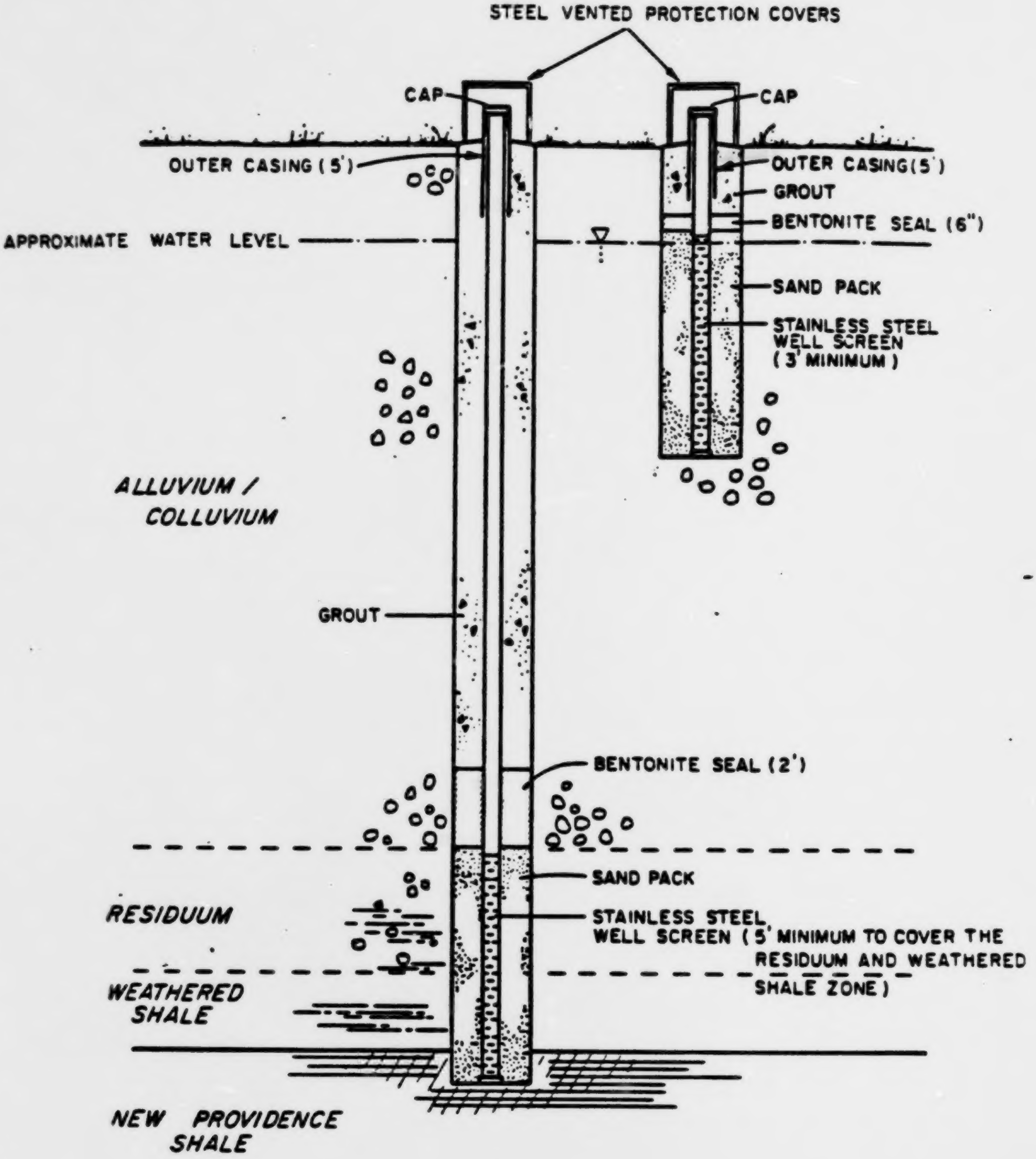

SOURCE: GEOSCIENCES RESEARCH ASSOCIATES, INC.

figure 3.3

TYPICAL MONITORING WELL CLUSTER
A.L. TAYLOR SITE
Bullitt County, Kentucky

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approximately 140 compounds have been identified. The chemicals found most often and in highest concentrations were:

xylene
methylene chloride
phthalates
toluene
alkyl benzene
dichloroethylene
methyl ethyl ketone
acetone
anthracene
fluoranthene
vinyl chloride
aliphatic acids

PCBs were detected in low concentrations and several metals including barium, zinc, copper, strontium, magnesium and chromium were detected in concentrations exceeding background levels.

The highest concentrations of organic contaminants detected on site, other than from drum samples, were from liquid samples collected in the test pits. The average concentration of the major organic compounds detected are found in the first column of Table 2. Some of the same compounds were detected in water samples from borings located downgradient of the test pits and are included in Table 2. It is significant to note that some water samples from the borings were collected immediately downgradient of the disposal cells, yet the analyses showed relatively low concentrations of contaminants when compared to the pit samples.

Groundwater and surface water resources were evaluated as potential routes of exposure to hazardous substances released from the A. L. Taylor site. Under existing and projected usage patterns neither of the sources appears to be a likely route of exposure to populations located downstream of surface water routes or downgradient of groundwater movement from the site.

Groundwater is not currently a source of drinking water in the vicinity of the site. The five homes located closest to the site are on cisterns, other nearby residences and businesses are either on cisterns or are connected to municipal water supplies. Poor water quality and low yield account for the low use of both shallow and deep aquifers near the site. An adjacent landowner had a well drilled but it was never used because of low yield. This well was sampled during the remedial investigation and found to contain concentrations of iron and manganese that were approximately 30 and 3 times National Drinking Water Standards, respectively.

Similarly, a deep well installed in the limestone aquifer during the remedial investigations had a flow rate of four gallons per minute and contained concentrations of chloride that exceeded National Drinking Water Standards by a factor of five.

Another factor limiting future human exposure risks is the limited population growth projected in the vicinity of the site. Topographic features of the area surrounding the site make it largely unsuitable for development.

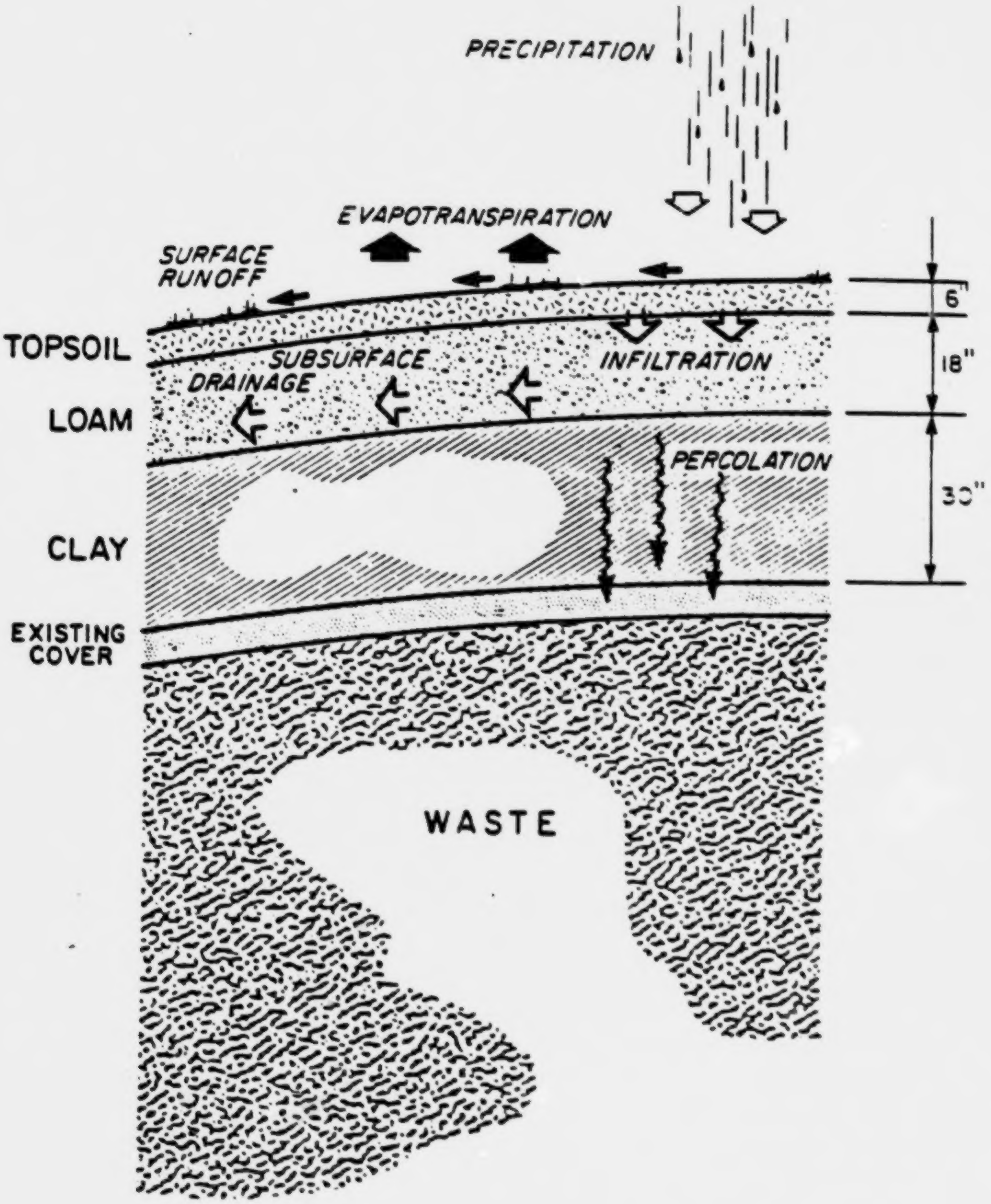

figure 6.2

FINAL COVER SCHEMATIC
A.L. TAYLOR SITE
Bullitt County, Kentucky

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Geohydrologic studies of the site show that migration of contaminants off site is likely to be very slow. The annual volume of groundwater moving through the site is calculated to be low and assuming the fastest rate of groundwater flow, 2.41 feet/year, and no attenuation of contaminants in the site soils, any contaminant plume might take 20 years to move 50 feet.

A deep well drilled on site revealed up to 85 feet of unweathered shale isolating the limestone aquifer from the contaminated overburden. Pressure permeability tests performed on both shale units indicated little or no fracturing in the formations reducing the likelihood of contaminants moving into the deeper limestone aquifer.

Surface water, like groundwater, is not believed to be a severe potential exposure route. The Salt River drainage basin which drains into the Ohio River is not a source of drinking water in the vicinity of the Salt-Ohio River confluence. Louisville does get its drinking water from the Ohio River but at a location upstream of the Ohio-Salt River confluence. No other water intakes are located along the Ohio River for many miles downstream but even if there were, the dilution factor (a million fold) should be great enough to prevent any measurable effects.

Potential exposure through recreational use of surface waters also is low due to the dilution factor. Recreational use of the streams leading from the site, although not documented, is believed to be low until the Salt River confluence is reached.

ENFORCEMENT

On April 1986, the United States filed a cost recovery action pursuant to Section 107 of CERCLA, Section 311 of the Clear Water Act, and Section 7003 of the Resource Conservation and Recovery Act for emergency and other response costs incurred at the site since 1979. The lawsuit was filed in the United States District Court for the Western District of Kentucky against the current and past owners and operators of the site and four of the primary generators. The pending action was filed following the unsuccessful conclusion of negotiations concerning future remedial activities at the site. Additional cost recovery may be expected as future remedial activities are completed at the site.

COMMUNITY RELATIONS

Two public meetings were held to present the recommended remedial alternative. The first meeting was held on August 11, 1982 to discuss the modified onsite containment/excavate-and relocate alternative. Representatives of EPA, KDNREPC, local authorities, local media and the community were present. Discussions were held outlining the development of the alternatives and the selection process. Following the public meeting, 30-day comment period was given. All reports and data were left on file at the Bullitt county courthouse. No written comments were received.

Another public meeting was scheduled for presentation of the second remedial alternative recommendation. In this second meeting, held on June 16, 1983, the onsite containment alternative was presented as the newly selected remedial alternative. As in the first meeting, community turnout was low and no written comments were received during the 30-day comment period following the public meeting.

ALTERNATIVE EVALUATION

Remedial alternatives evaluated at the A.L. Taylor Site are source control measures. The migration of hazardous substances from their original disposal area is minimal and the remedial alternatives considered are to control off-site migration.

The objectives of the remedial action are broad enough to address all routes of release but focus on those areas with the greatest potential for having adverse effects on public health and the environment. The remedy will also take into account cost-effective considerations. With these criteria, the following are the objectives for remedial action at the A.L. Taylor site:

1. The air quality will be protected by the control of emissions of particulate matter and toxic gases.

2. The recreational users and biota of downstream surface waters will be protected from leachate and contaminated runoff.

3. Groundwater, although low yielding and unpotable, contributes to surface water and will be protected by reducing aquifer recharge.

4. Local populations will be protected from direct contact with contaminated soils.

The following remedial alternatives were evaluated.

1. No Action

The no action alternative is not acceptable because the wastes would remain on site in an uncontrolled manner. The site would continue to pose a potential threat to Wilson Creek.

2. Minimum Action Alternative

This alternative consists of leaving all buried waste in place, regrading and revegetating the existing site surface, removing wastes from the open pit and surface dumping area northeast of the site, establishing a groundwater monitoring program, operating and maintaining the existing runoff collection and treatment system and preparing and filing a record plat. This alternative is developed as a base line comparison for the other alternatives and is not intended to meet the requirements of a RCRA facility.

3. Onsite Containment Alternative

The basic idea behind the onsite containment alternative is to isolate the buried hazardous waste without disturbing the existing waste cells. The RCRA regulations governing a hazardous waste landfill will be used as guide lines where possible.

The alternative includes a slurry wall keyed to bedrock, clay soil cover, leachate/gas collection system, leachate treatment system, runoff/drainage diverson, revegetation, security fence and sign, and record plat.

4. Excavate-And-Relocate Offsite

This alternative includes excavating most of the onsite contamination, transporting it to an approved disposal facility and restoring the site. This alternative will be most effective in controlling long-term pollution levels at the site. The cost of this approach is strongly dependent on distance to the ultimate disposal site.

Ultimate disposal facilities costs for contaminated soils are given for comparison in the Table 15

5. Modified Onsite Containment/Excavate-And-Relocate

This alternative combines onsite containment and excavate-and-relocate to provide a hybrid alternative. One approach considered was removing only the free liquid in the waste pits but was rejected for cost reasons. The approach developed will remove the most toxic and highly polluted material on site. Both groundwater and surface water diversion will be provided, to prevent soil moisture, shallow groundwater, and surface water from contacting these contaminated materials and acting as a transport medium Groundwater diversion will be accomplished by a combination of upgradient slurry walls and french drains. Surface water diversion will be provided by a drainage method similar to the diversion ditch proposed in the onsite containment alternative. In addition to diversion, a landfill cap will prevent vertical infiltration of rainwater into the contaminated zone. The landfill cap consists of 2 feet of topsoil and clay. The site will be surrounded with a chain link fence and a locking gate for site security. Monitoring wells will be installed between the site and Wilson Creek. Operation and maintenance requirements at the site will be kept to a minimum. Leachate collection requirements have been eliminated. Annual maintenance of the site will consist of repair of erosion damage, mowing and revegetation. Annual monitoring of the sampling wells will be required.

6. Excavate-and-Relocate Onsite

This alternative consisted of excavation of all contaminants onsite and placing them in a cell constructed onsite which would conform fully with RCRA requirements.

A conceptual design of a landfill cell was developed for consideration as a remedial alternative. The scope of this study included a geophysical remote sensing investigation of two areas within the general site which were being considered for the construction of the land disposal cell. The quantities of buried wastes found during the second phase of this investigation indicated much more waste remained onsite than could safely be disposed of in this small landfill area.

7. Modified Onsite Containment Alternative (Potential Responsible Party)

Geosciences Research Associates, Inc. (GRA) and Tenech Environmental Engineers, Inc. (TEE) have developed a modified onsite containment approach at the A. L. Taylor Site for the PRPs. This approach is based on work performed by Ecology and Environment, Inc. (E&E). This alternative consisted of an impermeable cap and soil cover, drainage diversion ditch, groundwater monitoring well system, site clearing, regrading and revegetation, security fence and signs.

Where possible RCRA regulations governing a hazardous waste landfill will be used as guidelines. The proposed cap will prevent surface runoff contact with contaminated soil and the subsequent generation of contaminated runoff. The installation of upgradient diversion ditches will eliminate surface runon.

Upgradient monitoring wells will be installed on the site to augment the existing downgradient system. The proposed modified containment alternative would mitigate the threat to public health and the environment by eliminating the present routes of exposure.

Initial Alternatives Recommended - 1982

On August 11, 1982 a Decision Memorandum was issued from EPA Region IV recommending the modified onsite containment/excavate-and-relocate alternative. A review meeting was held August 23, 1982 to discuss the recommendation. The meeting resulted in EPA Headquarters requesting additional information to justify removal of wastes offsite. As the result of these further studies the Modified Onsite Containment/Excavate-and-Relocate alternative could not be justified under the cost-effective requirements of CERCLA. EPA Headquarters indicated that the onsite containment alternative should be considered in more detail.

During negotiations for the final remedy, the Potentially Responsible Parties (PRPs) submitted a conceptual design for the onsite containment alternative. This conceptual design differed from the onsite containment alternative presented in the feasibility study in that the leachate collection system and slurry wall had been eliminated. EPA, Region IV requested additional information before the conceptual design could be fully evaluated. A hydrogeologic investigation was conducted by the PRPs consultants. This information was included as an addendum to the feasibility study prepared under EPA contract by Metcalf & Eddy, Inc. (M & E) in August, 1984.

The addendum also included updated cost estimates for the alternatives developed by E & E and gave cost estimates for the onsite containment alternative as proposed by the PRPs. For comparison an estimate for the cost of constructing a RCRA landfill onsite was given, and an endangerment assessment was added. These cost estimates are included in Table 3-7.

Table 3 presents a comparison of the most significant criteria affecting the alternative selection process. The alternatives are compared using the evaluation criteria presented in the feasibility study. Table 13 presents each of the alternatives and the important facts relative to each comparative evaluation criteria: reliability, implementability, RCRA conformance, safety and operation and maintenance.

Table 5 presents a summary of the proposed Remedial Alternative costs which includes capital cost for implementation of the remedy and the associated long-term monitoring costs.

In August 1985 the Potentially Responsible Parties (PRPs) submitted the conceptual design of the onsite containment alternative. EPA added the following changes:

1. to upgrade the proposed cap to conform with the guidelines of the Resource Conservation and Recovery Act (RCRA).
2. to install additional upgradient monitoring wells
3. to establish a long term operation and maintenance program that included a groundwater and surface water monitoring program, well maintenance, rehabilitation, cover, and cap maintenance.
4. Final slope of cover will be between three and five percent where possible.

The total cost with the additional EPA requirements added would be $713,250 for construction costs and $503,876 for O & M cost, with a total project cost of 1,217,126.

Recommended Alternative - 1986 (Alternative #7)

The selected remedy is consistent with the remedy first proposed in the EDD (1985) and is the most cost effective remedy which adequately protects the public health and welfare and the environment.

As a result of Negotiations with the Potentially Responsible Parties Committee, technical changes and considerations were made to the previously proposed remedy.

The selected remedy includes:

Removal of ponded water from the site.

Secure pond sediments, sludge and materials from low-lying areas beneath the cap.

Install final cap cover for containment of the waste materials.

Construct a surface water drainage diversion which will route surface water around the cap area and which can accommodate a 25 year/24 hour storm.

Implement a performance monitoring program on Wilson Creek (the only potential receptor of chemical migration) to evaluate the effectiveness of the clay cap to mitigate surface chemical migration.

Monitoring of groundwater quality will be accomplished by eight (8) newly installed nested wells placed along the Creek valley at four locations, to monitor both the shallow and the deeper groundwaters. In addition, these wells will provide an early warning of any contaminant movement toward Wilson Creek via groundwater, if groundwater is present.

Following the completion of the remedial construction, the site will be secured with the installation of a six foot high chain link fence with appropriate gates.

The site will be subject to a regular inspection and maintenance program following completion of remedial construction for a period of thirty (30) years.

The cover will consist of a 30- inch layer of clay to attain a permeability of 1 x 10 -7 cm/sec., followed by an 18-inch layer of material with a permeability between 10 -3 and 10 -5 cm/sec. A 6- inch layer of topsoil will be placed as final cover and vegetated with cover plants having root systems which will stabilize the top soil and loam against erosion but which will not penetrate the clay material of the cap.

The active contaminant migration pathway at the A.L. Taylor site is by surface water runoff. The final cover is proposed as a method of containing waste materials and preventing contact between surface water and waste.

RCRA Closure Standards

After review of the information, the decision was made that groundwater flow at the site is minimal, recharge rates are very slow and there are no residential (drinking) wells within miles of the site. Naturally occurring high levels of Mg & Ca in the groundwater also combine to make the groundwater marginally useful as a drinking water source. The naturally occurring soils fulfill the permeability requirements of RCRA closure standards.

RCRA Cap

The specifications for the RCRA cap are essentially the same as in the original remedy noted in the Feasibility Study. However, based on information supplied by the PRPs and review of the files, a flexible membrane liner does not appear to be needed at the A.L. Taylor Site. This decision was based on the very low permeability of the underlying materials.

Groundwater Monitoring Wells

Four (4) additional nested groundwater monitoring wells will be installed (2 at each location). Locations and specifications are in the project work plan.

The Remedial design of the final cover should accomplish the following objectives:

provide long-term minimization of migration of liquids through the final cover (to minimize leachate),

Function with minimum maintenance,

Promote drainage and minimize erosion or abrasion of the cover,

Accomodate settling and subsidence so that the cover's integrity is maintained,

Have a permeability less than or equal to the permeability of any bottom liner or natural subsoils present.

Listed below are programmed construction cost estimates.

PROGRAMMED CONSTRUCTION COST ESTIMATE

A. L. TAYLOR SITE REMEDIATION

PROJECT START-UP AND CLOSE-OUT	$ 28,500.00
HEALTH AND SAFETY	$ 22,000.00
SITE PREPARATION	$ 43,410.00
CAP PLACEMENT	$372,620.00
RESTORATION	$ 81,749.00
SUB-TOTAL	$548,279.00
CONTINGENCIES (25% of SUBTOTAL)	$137,070.00
ENGINEERING DESIGN, SUPERVISION AND CONTRACT MANAGEMENT	$110,000.00
TOTAL	$795,349.00

Remedial Alternative Analysis

The feasibility study for the A.L. Taylor site was initially developed by Ecology and Environment, Inc. (EE) in 1982. The study contained evaluations of minimum action, onsite containment, and excavate and relocate offsite alternatives. A modified alternative was subsequently developed. The modified onsite containment/excavate and relocate alternative was developed at the request of the KDNREP. This alternative was incorporated in the revised feasibility study. The following are the criteria used to assess the remedial options:

Reliability: This considers the extent to which a system, device, or technology will perform a desired function correctly for a number of repeated trials or for an extended period of time. Without test data to measure performance against an established standard, reliability of each alternative was based on scientific judgement. The alternatives were ranked as to their relative reliability without attempting to establish the quantitative reliability of each alternative.

Implementability: This is the physical, finanical and legal power to carry out the alternative. Because of the varied nature of the possible remedial alternatives, they were evaluated based on their ease of implementation. Consideration was given to public opinion, regulatory procedures, duration, scheduling, natural constraints (such as weather), and technical feasibility. The alternative that could be implemented most easily was given preference.

RCRA Conformance: Each alternative design was compared to new landfill design standards permitted under the Resource Conservation and Recovery Act (RCRA). The alternative which provided environmental protection performance similar, to a RCRA permitted landfill was given preference.

Environmental Concerns: These were identified for each alternative, and the alternative with the least adverse environmental impact received preference.

Safety Requirements: These were developed to mitigate the risks of construction of each alternative. Where necessary, risk assessments were made on each operation. The safety requirements and relative preference was given to the alternative having the lowest relative risk and least safety requirements.

Operation and Maintenance Efforts: Manpower and equipment requirements were identified for each alternative for a 30 year project period. Maintenance effort was based on parts replacement, corrosion control, and safety requirements when applicable. Operation personnel, utility cost, and major system replacement requirements for each alternative were developed. Preference was given to the alternative with the least long term commitment of capital, manpower, and equipment.

Table 14 presents a comparison of the most significant criteria affecting the alternative selection process. The alternatives are compared using the evaluation criteria presented in the feasibility study. Table 13 presents each of the alternatives and the important facts relative to each comparative evaluation criteria: reliability, implementability, RCRA conformance, safety, and operation and maintenance.

Table 1 presents a summary of the proposed Remedial Alternative costs which includes capital costs for implementation of the remedy and the associated long-term monitoring costs.

Consistency With Other Environmental Laws

-Clean Water Act is a state delegated program and the Commonwealth has not stated any objections to the selected alternative.

-There are no impacts to the air in the area therefore the remedy will comply with the Clean Air Act.

-No proposed actions will require TSCA compliance.

-Resource Conserative and Recovery Act (RCRA) staff have been contacted and state no objection to the proposed remedy.

Operation and Maintenance (O & M)

O & M costs at this site will be the collection and analysis of groundwater and surface water samples, maintenance of the fence, cap, vegetated cover and monitoring wells over a period of 30 years. The Commonwealth will assume these functions one year after completion of construction.

Funding

It is recommended that this remedy be funded at 10% Commonwealth funds, 90% Federal Funding.

Schedule

June 18, 1986	Sign Record of Decision
June 30, 1986	Initiate Remedial Design
March 31, 1987	Complete Design
September 1, 1987	Initiate Construction
September 1, 1987	Complete Construction

APPENDIX

TABLE 1. SUMMARY OF PROPOSED REMEDIAL ALTERNATIVE COSTS

Alternative	Capital Cost	O&M Costs	O&M Costs(1)	Total Costs(2)
E&E Minimum Action Alternative	$157,000	$114,676	$332,200	$489,200
E&E Onsite Containment Alternative	$602,000	$239,290	$704,000	$1,306,000
E&E Excavate-and Relocate Alternative	$2,934,000	$86,396	$242,200	$3,176,200
PRP Consultant Onsite Containment Alternative	$531,875	$114,676	$332,200	$864,075
RCRA Landfill Alternative	$1,423,100	$294,656	$890,300	$2,313,400
RCRA Offsite Disposal Alternative #1	$4,359,425	-	-	$4,359,425
RCRA Offsite Disposal Alternative #2	$5,497,285	-	-	$5,497,285

1. These costs assume that the cost escalation factor is the same as the interest rate, 10%.
2. The total cost includes the O&M costs with the cost escalation factor the same as the interest rate.

TABLE I

REMEDIAL ALTERNATIVES FOR THE A. L. TAYLOR SITE

ALTERNATIVE	#1 MINIMUM ACTION	#2 ON-SITE CONTAINMENT	#3 EXCAVATE AND REMOVAL	#4 MODIFIED REMOVAL
Description	(1) Leave all buried wastes in place (2) Regrade and revegetate the existing site surface (3) Remove wastes from the open pit and surface dumping area (4) Establish a groundwater monitoring program (5) Operate and maintain the existing runoff collection and treatment system (6) Prepare and file a record plat	(1) Install total slurry wall around waste site (2) Install clay cap and soil cover (3) Install leachate/gas collection system (4) Operate leachate treatment system (5) Install runoff/drainage diversion ditches (6) Revegetate (7) Install security fence and signs	(1) Remove all contaminated materials from waste cells, open pit, and surface dumping area. Transport to RCRA disposal facility (2) Backfill all excavated areas with truck-in fill (3) Regrade and revegetate the site (4) Prepare and file a record plat	(1) Remove contaminated materials from main disposal trench, open pit, and surface dumping area. Transport to RCRA facility (2) Backfill (3) Install upgradient slurry wall and french drain (4) Install clay cap and soil cover (5) Install surface water diversion ditches (6) Revegetate (7) Install security fence and sign (8) Install remedial monitoring wells (9) Prepare and file a record plat

#5
EXCAVATE AND RELOCATE ON-SITE

#6
MODIFIED ON-SITE CONTAINMENT (PRPs) PLUS EPA REQUIREMENTS UPGRADE TO RCRA CAP & LINER
Construction & O&M Cost - 1,217,126

#7
MODIFIED ON-SITE CONTAINMENT (PRPs)
Construction Cost - 795,349

	#1	#2	#3	#4
Construction Cost Range:	$ 119.000 - $211.600	$428,000 - $902,000	$1,589.000 - $4,641,000	$1,140.000
Midpoint:	$165,310	$665,000	$3,115.000	
Operation and Maintenance Cost: Range:	5 years: $38-$79,000 After 5 years:	1st year: $43-$77,000 After 1st year:	1st year: $20-$31,000 After 1st year:	1st year $20-$34,000 After 1st year:

TABLE 2 ORGANIC CHEMICAL CONCENTRATIONS IN GROUNDWATER. A. L. TAYLOR SITE

	Test Pit Liquid[1] 1979		Test Soil Borings[2] 1982	
	Average Condition	(Std. Deviation) ug/l		
Acenapthene	36,000	(80,498)	--	
Anthracene/Phenanthrene	34,000	(76,026)	--	
Bis (2-ethylhexyl) Phthalate	580,641	(1,296,562)	--	
Ethyl Benzene	7,704	(10,106)	1,150	(2,371)
Methyl Ethyl Ketone	7,940	(10,926)	--	
Methyl Isobutyl Ketone	9,976	(12,985)	--	
Napthalene	240,020	(536,645)	38	(28)
Toluene	11,980	(10,643)	1,642	(1,879)
Trans 1,2-Dichloroethylene	33,680	(70,648)	302	(598)
Vinyl Chloride	989	(1,264)	30	(60)
Xylene	2,212,360	(4,912,446)	NQ[3]	

1. U.S. EPA, 1979a. Liquid found in test pits dug by backhoe in principal area suspected of containing buried wastes. A-4, A-5, A-6, A-7, A-10. When no value was reported for a given site, zero concentration was assumed.
2. U.S. EPA, 1982c. Test wells drilled downgradient of same principal burial area. Average of K-16, L-14, L-12,L-11. When not detected in a given test well, zero ug/l was assumed.
3. NQ - Detected but not quantified.

TABLE 2.1

SUMMARY OF SITE PERMEABILITIES

Formation	Horizontal Permeability (cm/sec.)	Vertical Permeability (cm/sec.)
Alluvium/colluvium	1.8×10^{-6} to 5.3×10^{-6}	2.5×10^{-7} to 7.0×10^{-7}
Residuum	--	4.5×10^{-7} to 1.7×10^{-8}
Weathered Shale	3.3×10^{-5} to 9.1×10^{-6}	2.0×10^{-7} to 4.5×10^{-7}
New Providence (Unweathered Shale)	--	6.3×10^{-8}

Notes: (1) Horizontal permeabilities determined from well response tests.
(2) Vertical permeabilities determined from laboratory permeability tests.

Source: Geosciences Research Associates, 1984.

TABLE 3 UPDATE OF E&E CONSTRUCTION COST ESTIMATE FOR THE MINIMUM ACTION ALTERNATIVE

	Cost, Thousand Dollars			
	1982		1984	
Item	Lower	Upper	Lower	Upper
Pit and Surface Dumping:				
Excavation & Backfill	12.6	18.9	13.5	20.2
Transport & Disposal	51.7	79.5	55.3	85.1
Site Rehabilitation (Minor grading, fertilizing, trees, seeding & mulching)	4.0	5.0	4.3	5.4
Wastewater treatment renovation/ operation/disassembly*	26.8	68.6	28.7	73.4
Monitoring Wells	10.5	10.5	11.2	11.2
Security & Safety, Plat Survey & Legal Fees	2.0	3.0	2.1	3.2
Warning Signs	0.1	0.1	0.1	0.1
TOTAL	107.7	185.6	115.2	198.6

* The wastewater treatment system will be renovated so that the lagoon water can be treated. Once the lagoon water is treated, the system will be disassembled and shipped to the KDNREP.

TABLE 4 UPDATE OF E&E CONSTRUCTION COST ESTIMATE FOR THE ONSITE CONTAINMENT ALTERNATIVE

Cost, Thousand Dollars				
1982	1984			
Item	Lower	Upper	Lower	Upper
Slurry Wall	70	120	75	128
Clay Cap	52	102	56	109
Topsoil Cover	60	100	64	107
Drainage Diversion Channel	4	7	4	7
Monitoring Wells (1-up;3 down)	8	13	9	14
Leachate Collection System	43	72	46	77
Wastewater treatment renovation/ operation/disassembly	207	69	29	73
Site Grooming, Clearing, Grubbing & Initial Revegetation	4	7	4	7
Security Fence, Gate, Signs	28	46	30	49
Utilities Installation	1	1	1	1
Record Plat	3	4	3	4
Project Management, Monitoring, Sampling and Permitting	40	60	43	64
SUB-TOTAL	340	601	364	640
Undefined Details & Contingencies (20%)	68	120	73	128
TOTAL	408	721	437	768

TABLE 5 UPDATE OF E&E CONSTRUCTION COST ESTIMATE FOR THE EXCAVATE-AND-RELOCATE ALTERNATIVE

	Cost, Thousand Dollars			
	1982		1984	
Item	Lower	Upper	Lower	Upper
Agency Management	5	12	5	13
Project Management	15	32	16	34
Pre-Excavation Sampling and Permitting	29	29	31	31
Mobilization	17	17	18	19
Excavation	85	204	91	218
Pollution Control*	68	151	73	162
Backfilling & Topsoil	80	179	86	192
Closure	29	32	31	34
Utilities	1	1	1	1
SUBTOTAL	329	657	352	704
Undefined Details (10%)	33	66	35	70
Contingencies (10%)	33	66	35	70
SUBTOTAL	395	789	422	844
Transport & Disposal	1,000	3,300	1,070	3,531
TOTAL	1,395	4,089	1,492	4,375

* E&E has included the wastewater treatment costs in this item.

TABLE 6 SUMMARY OF CONSTRUCTION COST ESTIMATE FOR PRP CONSULTANT REMEDIAL ALTERNATIVE

Technology	Cost
Site Clearing	$7,930
Renovation of Treatment System	$39,200
Processing Lagoon Water	$7,000
Removal of Renovated Treatment System	$9,800
Diversion Trench Installation	$39,875
Site Grading	$22,820
Monitoring Well System	$18,200
Site Cover and Cap	$313,150
Revegetation	$28,300
Security Fence and Signs	$40,600
Record Plat	$5,000
	$531,875

TABLE 7 SUMMARY OF CONSTRUCTION COST ESTIMATE FOR A NEW RCRA LANDFILL

Technology	Cost
Site Clearing	$7,930
Renovation of Treatment System	$39,200
Processing Lagoon Water	$7,000
Removal of Renovated Treatment System	$9,800
Excavation and On-Site Storage of Site Soils	$420,000
Diversion Trench Installation	$39,875
Bottom Liner and Leachate Control	$234,080
Monitoring Well System	$25,200
Site Cover and Cap	$573,525
Revegetation	$21,500
Security Fence and Signs	$40,000
Record Plat	$5,000
	$1,423,110

TABLE 8 PRESENT WORTH CALCULATION(1) OF THE LONG TERM MONITORING COSTS-MINIMUM ACTION ALTERNATIVE

1. Sampling/analytical costs:	
P/A - 1st year - $18,000	$16,364
P/A - 4 years - $9,000/year = $28,530	
P/F - 1 year - $28,530	$25,936
P/A - 25 years - $6,000/year = $54,420	
P/F - 5 years - $54,420	$33,790
2. Replacement of Monitoring Wells	
P/F - 15 years - $18,200	$4,358
3. Well Maintenance and Rehabilitation	
P/A - 50% - 5 - $4,000	
P/F - 5, 10, 15, 20, 25 years - $4,000	$5,948
4. Cover and Cap Maintenance	
P/A - 30 years - $3,000	$28,280
	$114,676

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1. Assume: 10% interest.

TABLE 9 PRESENT WORTH CALCULATION(1) OF THE LONG TERM MONITORING COSTS-ONSITE CONTAINMENT ALTERNATIVES

1. Leachate management system*	
P/A - 30 years - $9,000/year	$ 84,834
2. Sampling/analytical costs:	
P/A - 1st year - $18,000	16,364
P/A - 4 years - $9,000/year = $28,530 P/A - 1 year - $28,530	25,936
P/A - 25 years - $6,000/year = $54,420 P/F - 5 years $54,420	33,790
3. Replacement of Monitoring Wells	
P/F - 15 years - $18,200	4,358
4. Well Maintenance and Rehabilitation	
P/A - 50% - 5- $4,000 P/F - 5, 10, 15, 20, 25 years - $4,000	5,948
5. Cover and Cap Maintenance	
P/A - 30 years - $3,000	28,280
6. Gas Monitoring	
P/A - 1 year - $12,000/year	10,900
7. Miscellaneous (utilities, surface water control maintenance)	
P/A - 30 years - $3,000/year	28,280
	$239,290

1. Assume: 10% interest

* The operation and maintenance costs for the leachate management system include depreciation costs for the leachate pump and storage tank, $1,200 per year, and the offsite shipment and disposal of 120 55 gallon drums of leachate per year at a cost of $65 per drum.

TABLE 10 PRESENT WORTH CALCULATION(1) OF THE LONG TERM MONITORING COSTS-EXCAVATE-AND-RELOCATE ALTERNATVE

1. Sampling/analytical costs:	
P/A - 1st year - $18,000	$16,364
P/A - 4 years - $9,000/year = $28,530'	25,936
P/F - 1 year - $28,530	
P/A - 25 years - $6,000/year = $54,420	33,790
P/F - 5 years - $54,420	
2. Replacement of monitoring Wells	
P/F - 15 years - $18,200	4,358
3. Well Maintenance and Rehabilitation	
P/A - 50% - 5 - $4,000	5,948
P/F - 5, 10, 15, 20, 25 years - $4,000	
	$86,396

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1. Assume: 10% interest

TABLE 11 PRESENT WORTH CALCULATION(1) OF THE LONG TERM MONITORING COSTS - PRP CONSULTANT ALTERNATIVE

1. Sampling/analytical costs:	
P/A - 1st year - $18,000	$16,364
P/A - 4 years - $9,000/year = $28,530	
P/F - 1 year - $28,530	$25,936
P/A - 25 years - $6,000/year = $54,420	
P/F - 5 years - $54,420	$33,790
2. Replacement of Monitoring Wells	
P/F - 15 years - $18,200	$4,358
3. Well Maintenance and Rehabilitation	
P/A - 50% - 5 - $4,000	
P/F - 5, 10, 15, 20, 25 years - $4,000	$5,948
4. Cover and Cap Maintenance	
P/A - 30 years - $3,000	$28,280
	$114,676

---

1. Assume: 10% interest

TABLE 12 PRESENT WORTH CALCULATION(1) OF THE LONG TERM MONITORING COSTS - RCRA LANDFILL

1. Leachate Management System*	
P/A - 30 years - $9,000/year	$84,834
2. Sampling/analytical costs:	
P/A - 1st year - $26,000	$23,636
P/A - 4 years - $13,000/year = $41,207	
P/F - 1 year - $41,207	$37,460
P/A - 25 years - $8,600/year = $78,000	
P/F - 5 years - $78,000	$48,431
3. Replacement of Monitoring Wells	
P/F - 15 years - $27,300	$6,535
4. Well Maintenance and Rehabilitation	
P/A - 50% - 5 - $6,000	
P/F - 5, 10, 15, 20, 25 years - $6,000	$8,900
5. Cover and Cap Maintenance	
P/A - 30 years - $3,000/year	$28,280
6. Gas Monitoring	
P/A - First year - $12,000/year	$10,900
7. Miscellaneous (utilities, surface water control maintenance)	
P/A - 30 years - $3,000/year	$28,280
	$277,276

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1. Assume: 10% interest.

* The operation and maintenance costs for the leachate management system include depreciation costs for the leachate pump and storage tank, $1,200, and the offsite shipment and disposal of 120 55 gallon drums of leachate per year at a cost of $65 per drum.

TABLE 13

COMPARISON EVALUATION CRITERIA

	ALTERNATIVE	
ITEM	MODIFIED ONSITE CONTAINMENT ALTERNATIVE (POTENTIALLY RESPONSIBLE PARTIES)	ONSITE CONTAINMENT POTENTIALLY RESPONSIBLE PARTIES
Operation & Maintenance	Significant maintenance for 5 years; monitoring for 30 years	Significant maintenance for 5 years; monitoring for 30 years
Environmental Protection	Control of air emissions Control of surface runoff Control of groundwater Control of direct contact	Control of air emissions Control of surface runoff Control of groundwater Control of direct contact

(f)

TABLE 13

COMPARISON EVALUATION CRITERIA

ITEM	ALTERNATIVE	
	MODIFIED ONSITE CONTAINMENT EXCAVATE-AND-RELOCATE	EXCAVATE-AND-RELOCATE OFFSITE
Reliability	Waste removed 4 of 4 release pathways controlled treatment plant eliminated minor long-term commitment to monitoring	Waste removed excavation of all contaminants placing them in a cell constructed onsite which would conform fully with RCRA requirements. Results of a geophysical investigation showed that the size of a disposal cell that could be constructed on site in a suitable area had insufficient capacity material buried at the site.
Implementability	Technically possible limited technically skills required landowner's consent likely potential community support	Technically not possible due due to insufficient land capacity to contain the material
RCRA Conformance	Conforms except for no bottom liner	Conforms except for no bottom liner
Safety	No risk of fire or explosion; medium risk of toxic gas release or spill	No risk of fire or explosion; medium risk of or spill toxic gas release or spill

(e)

TABLE 13

COMPARISON EVALUATION CRITERIA

	ALTERNATIVE	
ITEM	MODIFIED ONSITE CONTAINMENT/ EXCAVATE-AND-RELOCATE	EXCAVATE-AND-RELOCATE ONSITE
Operation & Maintenance	Significant maintenance for 5 years; monitoring for 30 yeras	Significant maintenance for 5 years; monitoring for 30 years
Environmental Protection	Control of air emissions Control of surface runoff Control of groundwater Control of direct contact	Control of air emissions Control of surface runoff Control of groundwater Control of direct contact

(d)

TABLE 13

COMPARISON EVALUATION CRITERIA

ITEM	ALTERNATIVE	
	MODIFIED ONSITE CONTAINMENT EXCAVATE-AND-RELOCATE	EXCAVATE-AND-RELOCATE ONSITE
Reliability	Waste removed 4 of 4 release pathways controlled treatment plant eliminated minor long-term commitment to monitoring	Waste removed excavation of all contaminants placing them in a cell constructed onsite which would conform fully with RCRA requirements. Results of a geophysical investigation showed that the size of a disposal cell that could be constructed on site in a suitable area had insufficient capacity material buried at the site.
Implementability	Technically possible limited technically skills required landowner's consent likely potential community support	Technically not possible due to insufficient land capacity to contain the material
RCRA Conformance	Conforms except for no bottom liner	Conforms except for no bottom liner
Safety	No risk of fire or explosion; medium risk of toxic gas release or spill	No risk of fire or explosion; medium risk of toxic gas release or spill

(c)

TABLE 13
(CONTINUED)
COMPARISON EVALUATION CRITERIA

	ALTERNATIVE		
ITEM	MINIMUM ACTION	ONSITE CONTAINMENT	EXCAVATE-AND-RELOCATE OFFSITE
Operation & Maintenance	Major commitment of manpower and money for 5 years Significant maintenance for 30 years Monitoring for 30 years	Significant maintenance for 30 years Monitoring for 30 years	Significant maintenance for 5 years Monitoring for 30 years
Environmental Protection	Does not control air emissions Limited control of surface runoff No control of groundwater No control of direct contact	Control of air emissions Control of surface runoff Control of groundwater Control of direct contact	Control of air emissions Control of surface runoff Control of groundwater Control of direct contact

(b)

TABLE 13

COMPARISON EVALUATION CRITERIA

ITEM	ALTERNATIVE		
	MINIMUM ACTION	ONSITE CONTAINMENT	EXCAVATE-AND-RELOCATE OFFSITE
Reliability	Waste remains Natural containment of limited certainty Treatment plant overflows occasionally Long-term commitment to maintenance and monitoring	Waste remains 4 of 4 release pathways contained Treatment plant eliminated Long-term commitment to maintenance and monitoring	Waste removed 4 of 4 release pathways controlled Treatment plant eliminated Minor long-term commitment to monitoring
Implementability	Technically possible Needs technical expertise at WTP Needs owner permission Potential community opposition Zoning of WTP needed	Technically possible Limited technical skills needed Need owner permission Potential community support	Technically possible Limited technical skills required Landowner's consent likely Potential community support
RCRA Conformance	Does not conform	Conforms except for no botton liner	Conform by placement of waste in RCRA facility
Safety	Minor risks of fire, explosion, toxic gas release or spill	No risk of fire, explosion, toxic gas release or spill	No risk of fire or explosion; medium risk of toxic gas release or spill

(a)

TABLE 14

DECISION MATRIX OF MOST SIGNIFICANT SELECTION CRITERIA

ELEMENTS OF COMPARISON	(1) MINIMUM ACTION	(2) ONSITE CONTAINMENT	(3) EXCAVATE AND RELOCATE	(4) PRP ONSITE CONTAINMENT (a)
Long-Term Release Control				
Air	Slight	Yes	Yes	Yes
Surface Runoff	Slight	Yes	Yes	Yes
Groundwater	No	Yes	Yes	Yes
Direct Contact	No	Yes	Yes	Yes
Life Cycle Cost	Least	Middle	Most	Less than Option (2)
RCRA Conformance	No	Potentially Yes (b)	Yes	Potentially Yes (c)
Reliability	Poor	Excellent	Superior	Excellent
Operation & Maintenance Cost	Most	Middle	Least	Middle

a. Onsite containment modified by elimination of slurry wall and leachate collection

b. Assuming integrity of shale layer.

c. Weathered shale may serve as a slow to medium release mechanism for limited quantities of shallow ground-water.

TABLE 15

ULTIMATE DISPOSAL FACILITIES FOR CONTAMINATED SOILS

LANDFILL	HAUL DISTANCE (one-way miles)	DISPOSAL COST (dollar/yd^3)
B.H.S., Inc. Wright City, Missouri	331	48.90
CECOS Cincinnati, Ohio	136	80.00
Chemical Waste Management Emelle, Alabama	515	50.00
U.S.Ecology Sheffield, Illinois	450	178.00
Adams Center Landfill Ft. Wayne, Indiana	273	40.00
Incinerator		
LWD, Inc. Paduka, Kentucky	240	250.00

VOLATILE ORGANIC COMPOUNDS DETECTED IN MAIN LANDFILL WELLS
(CONCENTRATIONS IN MICROGRAMS/LITER)
TYBOUTS CORNER LANDFILL SITE
PAGE TWO

Volatile Organic Compounds	Location Well No. (Date)	Columbia formation– (Screen Below Base of Main Landfill, Avoce Merchantville)				Potomac, No. 1 Sand– (Screen Below Base of Main Landfill, Below Merchantville)							
		314		315		303		310		312		MP-3A	
		(2/84)	(5/84)	(1/84)	(5/84)	(1/84)	(5/84)	(2/84)	(5/84)	(2/84)	(5/84)	(5/84)	(5/84)
Benzene		36	14	17	24.1			17		7			
Chlorobenzene				8.6	10.7								
1,2-Dichloroethane		2240	847	LT						21	3.2		
1,1-Dichloroethane						LT	4.6						
Chloroethane			6.8			16	8.8						
Chloroform													
1,2-Trans-dichloroethane		144	38.4			LT		11					
Ethylbenzene		181	16.1	220	365			16	4.8				
Chloromethane													
Fluorotrichloromethane													
Tetrachloroethene (PCE)													
Toluene		2220	94	20	5.7			680	478				9.6K
Trichloroethene (TCE)		0											
Vinyl chloride		82	25.4					15					
Acetone		2060	38.6C		LT				4180		244		
2-Butanone (MEK)		2040	122C					8460		266			
4-Methyl-2-pentanone (MIBK)		78	15.1		4.2			640	112	6			
o-Xylene or total		1460	30.6	43	184			31	10.8				
2-Hexanone					5.1								

NOTE:

LT = Less than detection limit, but greater than 1/2 detection limit.
K = Value is less than value given.

Table 2

VOLATILE ORGANIC COMPOUNDS DETECTED IN WEST LANDFILL WELLS,
POTOMAC FORMATION, NO. 1 SAND
(Concentrations in Micrograms/Liter)
TYBOUTS CORNER LANDFILL SITE

Volatile Organic Compounds	Location Well No. (Dates)	Potomac Formation, No. 1 Sand							
		Upgradient 213		Upgradient Edge 307		Within Fill 308		Downgradient Edge 304	
		(1/84)	(5/84)	(1/84)	(5/84)	(1/84)	(5/84)	(1/84)	(5/84)
Benzene		Non							
Chlorobenzene						36	17(18)	LT	28(32)
12-Dichloroethane						80	47(38)		4K
11-Dichloroethene							3K	83	31(14)
Chloroethane						LT	4K		
Chloroform									4K
12-trans-Dichloroethene									
Ethylbenzene						23			
Chloromethane						12	28	280	327(306)
Fluorotrichloromethane									
Tetrachloromethane (PCE)									
Toluene									
Trichloroethene (TCE)					4K	430	840(870)	1100	832(1186)
Vinyl chloride									8K
Acetone						8			
Styrene						100	187	1100	1068(1170)
2-Butanone (MEK)								80	
4-methyl-2-pentanone (MIBK)							49	LT	724(847)
o-Xylene or total							8K		118(121)
Dichlorofluoromethane						62	58	230	838(850)
Styrene							4K		
									40(47)

NOTE: LT = Less than detection limit but greater than 1/2 detection limit
K = Value is less than value given
( ) = Indicates Laboratory Replicate

Table 3

VOLATILE ORGANIC COMPOUNDS DETECTED IN THE
COLUMBIA FORMATION AND POTOMAC FORMATION, NO. 2 SAND AND BELOW THE NO. 2 SAND
(Concentrations in Micrograms/Liter)
TYBOUTS CORNER LANDFILL SITE

Volatile Organic Compounds	Location Well TY	Columbia Formation - (Downgradient from Main Fill)										No. 2 Sand Potomac Formation			Potomac Formation below the No 2 Sand	
		202	202	203	203	214	214	MP-10	MP-10	MP-11	MP-11	105	106	106	104	104
	(Date)	(1/84)	(5/84)	(1/84)	(5/84)	(2/84)	(5/84)	(2/84)	(5/84)	(1/26)	(5/84)	(1/84)	(5/84)	(5/85)	(2/84)	(5/84)
Benzene		74	53					6		28	18.8	23		82		
Chlorobenzene										5	4.4			2.1		
1,2-Dichloroethane		4800	2578	10000	8410	232					8					
1,1 Dichloroethane		21	11			695	2.2K			6	4.9					
Chloroethane		45	40							50	28.4	8	11.8	8.1		
Chloroform																
1,2-Trans-dichloroethene			504							8	7.6					
Ethylbenzene												LT		45		
Chloromethane																
Fluorotrichloromethane																
Tetrachloroethene		160	58			49	4.6K									
Toluene		19	3K									LT	6.2C	5.6	8	
Trichloroethene		140	87			21	11.2									
Vinylchloride		81									6.4					
Acetone		18										LT				
2-butanone (MEK)					10648								10.6C			
4-methyl-2 pentanone (MIBK)																
o-xylene or total										8	7.8	18	81	260	15	

(NOTE: LT = Less than detection limit, but greater than 1/2 detection limit)
C = Corrected for blank
K = Value is less than value given

Table 4

VOLATILE ORGANIC COMPOUNDS DETECTED IN THE POTOMAC FORMATION NO. 1 SAND
(CONCENTRATIONS IN MICROGRAMS PER LITER)
TYBOUTS CORNER LANDFILL SITE

Volatile Organic Compounds	Location Well No. (Date)	Potomac Formation, No. 1 Sand (Downgradient From Main Fill)									
		102 (1/84)	102 (5/84)	103 (1/84)	103 (Dup) (1/84)	103 5/84	204 (1/84)	204 (5/84)	114 (2/84)	114 (5/84)	114 (1/85)
Benzene							12	12.8			
Chlorobenzene		LT									
1,2-Dichloroethane											
1,1-Dichloroethane			2K			1K					
Chloroethane				10	8.4	12		8.6		422	165
Chloroform											
1,2-trans-Dichloroethane											
Ethylbenzene							45		8		22
Chloromethane											
Fluorotrichloromethane											
Tetrachloroethene (PCE)			8K				18	14.7			
Toluene									7		2.2
Trichloroethene (TCE)											4
Vinyl chloride											
Acetone							48		31		5
2-Butanone (MEK)											
4-Methyl-2-pentanone (MIBK)							200	6.6	8		
o-Xylene or Total							81	123.2	17		
Dichlorodifluoromethane											

Table 5

VOLATILE ORGANIC COMPOUNDS DETECTED IN THE POTOMAC FORMATION NO. 1 SAND
(CONCENTRATIONS IN MICROGRAMS PER LITER)
TYBOUTS CORNER LANDFILL SITE
PAGE TWO

Volatile Organic Compounds	Location Well (Date)	Potomac Formation, No. 1 Sand (Downgradient From Main Fill)											
		206 (1/84)	205 (Dup) (1/84)	205 (5/84)	205 (Dup) (5/84)	205 (1/85)	207 (1/84)	207 (5/84)	208 (1/84)	208 (5/84)	209 (2/84)	209 (5/84)	209 (Dup) (5/84)
Benzene		68	84			66			12				
Chlorobenzene						4			LT				
1,2 Dichloroethane		86	83	88.4	72.9	13	6	7.8	LT	586	9		
1,1 Dichloroethane		8	8.7	12.1	8.1	6.9							
Chloroethane		11	12	5.0	8.1	7.6			350	284			
Chloroform													
1,2-trans-Dichloroethane		12	8.6	24.7	16.5	2.3			14	6			
Ethylbenzene						28							
Chloromethane													
Fluorotrichloromethane													
Tetrachloroethene (PCE)													
Toluene		10	12			9.8					11		
Trichloroethene (TCE)													
Vinyl chloride		LT	LT	18.2	18.3				LT				
Acetone													
2-Butanone (MEK)						3					8		
4-Methyl-2-pentanone (MIBK)													
o-Xylene or Total		28	26	11.2	11.5	120			LT				
Dichlorodifluoromethane						60		4.8					

Table 6

VOLATILE ORGANIC COMPOUNDS DETECTED IN THE POTOMAC FORMATION NO. 1 SAND
(CONCENTRATIONS IN MICROGRAMS PER LITER)
TYBOUTS CORNER LANDFILL SITE
PAGE THREE

Volatile Organic Compounds	Location Well (Date)	Potomac Formation, No. 1 Sand (Downgradient From Main Fill)										
		210 (1/84)	210 (5/84)	210 (Dup) (5/84)	211 (1/84)	211 (5/84)	212 (1/84)	212 (5/84)	214 (2/84)	214 (5/84)	1168 (1/85)	119 (Du (1/8
Benzene		7	2.6K	3								
Chlorobenzene		6										
1,2-Dichloroethene		18			6.5			6.6	232			
1,1-Dichloroethane		18	7.8						6	2.2K		
Chloroethane												
Chloroform												
1,2-trans-Dichloroethene		6	14.3	8	32							
Ethylbenzene		4										
Chloromethane												
Fluorotrichloromethane												
Tetrachloroethene (PCE)					18	4K			40	4.8K		
Toluene		17		5K								
Trichloroethene (TCE)		6	4.6K	8					21	11.2	4	4
Vinyl chloride					12							
Acetone		190	86.5	82								
2-Butanone (MEK)		230	13.8	28								
4-Methyl-2-pentanone (MIBK)												
o-Xylene or total		5										
Dichlorodifluoromethane												

NOTES:

LT - Less than detection limit, but greater than 1/2 of detection limit.
K - Value is less than value given

Table 7

SUMMARY OF ORGANIC COMPOUNDS(1) IN SEDIMENTS

	Pigeon Run							Red Lion Creek			
	Upgradient		Downgradient					Upgradient	Downgradient		
	001	002	003	004	006	012	TCL-6	005	013	015	014
Benzene											
Ethylbenzene											LT [42.5]
Fluorotrichloromethane											LT [42.5]
Toluene									50	LT [43](2)	51
Acetone											190
2-butanone (MEK)									LT [252]		9700
2-hexanone											51,000
4-methyl-2-pentanone											LT [850]
1,2-dichloroethane											1200
Phenol									17		
4-methyl phenol											LT [14000
											31,000

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(1) Includes all organic compounds detected, except methylene chloride. All values in µg/l.
(2) LT [4.3] = less than detection limit, but greater than 1/2 detection limit. Number in brackets [ ] is the detection limit.

Table 8

Table 9 shows the results of chemical analyses for organic compounds conducted on leachate samples. The results show numerous organic compounds in the leachate, including benzene, chlorobenzene, 1,2-dichloroethane, chloroethane, 1,2-trans-dichloroethane, ethylbenzene, toluene, vinyl chloride, acetone, 2-butanone (MEK), o-xylene, 2-hexanone, and 4-methyl-2-pentanone.

Endangerment and Wetlands Assessments

The major potential impact from the landfill on the ecology of the area is the impact of leachate contamination on Red Lion Creek Marsh and on Pigeon Run wetlands. Analyses conducted for the RI indicate that organic contaminants in the creeks and wetlands at and downgradient from the leachate seeps are not at levels considered harmful to the ecology. Table 10 lists the range of concentrations for chemicals detected in the leachate discharges and surface waters of Pigeon Run, Red Lion Creek, and the unnamed tributary to Red Lion Creek, as compared to the acute and chronic toxicity concentrations for freshwater aquatic life.

The discharge to Pigeon Run contains some organics that may be toxic but the discharge has not degraded Pigeon Run to the point where metals and organics are toxic to aquatic life.

The unnamed tributary does not receive visable leachate and contained no metals or organics that are either acutely or chronically toxic to aquatic life.

The leachate discharge to Red Lion Creek enters near the Route 13 bridge in an area of marsh vegetation covered by several inches of marsh water. Some of the vegetation is stressed directly from the reddish brown leachate seeps. The leachate contains metals (cadmium, iron, lead, manganese) that may be acutely or chronically toxic to aquatic life. The discharge also contains some organic compounds at elevated concentrations, but none exceed the level for acute or chronic toxicity where values are available.

The sediments collected at the leachate discharge have a higher concentration of organic compounds than the leachate itself, but the levels were below reported toxicity values.

The main potential impacts on ecological biota may be degradation of water quality due to biological oxygen demand (BOD_5) and chemical oxygen demand (COD) loadings, and not from the organic or inorganic contaminants detected onsite. The main source of BOD_5 and COD, in some leachates and ground water, would be the leachate discharged from the site. In addition, excess nutrients in the leachates may enhance the production of algae

LEACHATE CONTAMINANTS
TYBOUTS CORNER LANDFILL SITE

PP#	CAS No.	Contaminant	No. of Positive Detections/ No. of Observations	Range of Concentration (µg/l)
4V	71-43-2	*benzene	4/6	13.0 - 80
7V	108-90-7	chlorobenzene	4/6	6.3 - 615
10V	107-06-2	*1,2-dichloroethane	1/6	29
16V	75-00-3	chloroethane	4/6	7.2 - 34
30V	156-60-5	1,2-trans-dichloroethene	3/6	8 - 160
38V	100-41-4	*ethylbenzene	4/6	20 - 81
44V	75-09-2	*methylene chloride	3/6†	29 - 280
86V	108-88-3	*toluene	6/6	10 - 380
	67-64-1	acetone	5/6	160 - 3,500
	78-93-3	*2-butanone (MEK)	5/6	580 - 11,000
	95-47-6	o-xylene	4/6	18 - 73

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* Critical Contaminant

† Found in blank @ 60 µg/l

Table 9

TABLE 7-7

LEACHATE DISCHARGE AND SURFACE WATER ANALYSES AND FRESHWATER AQUATIC LIFE TOXICITY TYBOUTS CORNER LANDFILL SITE

Chemical Constituent	Leachate Discharge to Ditch Flowing to Pigeon Run (ug/l)	Pigeon Run (ug/l)	Unnamed Tributary (ug/l)	Red Lion Creek (ug/l)	Leachate Discharge to Red Lion Creek (ug/l)	Freshwater Aquatic Life Toxicity (ug/l) Acute	Freshwater Aquatic Life Toxicity (ug/l) Chronic
aluminum	ND - 1,000	ND - 101	109 - 134	ND - 86	1,200		
arsenic	ND - 10	—	--	--	14		
barium	200 - 2,050	ND - 120	101 - 102	ND - 111	3,000	440	40
cadmium	ND - 5	—	—	—	28		50,000
chromium (total)	ND - 10	—	--	--	20	1.5 - 6.3	0.01 - 0.0
iron	900 - 673,000	ND - 548	109 - 282	178 - 240	400,000	2,200 - 9,800	44
lead	ND - 10	—	—	--	15		1,000
manganese	450 - 5,840	118 - 339	67 - 102	131 - 486	4,000	74 - 400	0.75 - 20
nickel	ND - 40	—	—	—	—		1,000
tin	--	ND - 114	—	--	—	1,100 - 3,100	56 - 160
zinc	ND - 400	ND - 39	18	18 - 34	20		
4-methylphenol	—	—	ND - 30	—	—	180 - 570	47
acetone	ND - 3,500	—	—	--	2,400		
benzene	ND - 45	—	—	—	80		
2-butanone	ND - 8,400	—	--	--	11,000	5,300	212 est.
chlorobenzene	ND - 15	—	--	--	—		
chloroethene	ND - 34	—	—	—	—	260	10 est.
1,2-dichloroethene	ND - 28	ND - 8	—	—	—	118,000	20,000
trans-1,2-dichloroethene	ND - 240	—	--	--	—	118,000	20,000
ethylbenzene	20 - <100	—	--	--	—	11,600	464 est.
2-hexanone	ND - 280	—	—	—	—	32,000	1,280 est.
methylene chloride	ND - 280	ND - 61	—	ND - 8	—		
styrene	ND - <5	—	—	—	--	11,000	440 est.

Table 10

LEACHATE DISCHARGE AND SURFACE WATER ANALYSES AND
FRESHWATER AQUATIC LIFE TOXICITY
TYBOUTS CORNER LANDFILL SITE
PAGE TWO

Chemical Constituent	Leachate Discharge to Ditch Flowing to Pigeon Run (ug/l)	Pigeon Run (ug/l)	Unnamed Tributary (ug/l)	Red Lion Creek (ug/l)	Leachate Discharge to Red Lion Creek (ug/l)	Freshwater Aquatic Life Toxicity (ug/l) Acute	Freshwater Aquatic Life Toxicity (ug/l) Chronic
toluene	16 - 300	--	--	--	380	17,500	700 est.
trichloroethene	ND - 8	--	--	--	--	45,000	1,800 est.
vinyl chloride	ND - <100	--	--	--	--		
xylene	ND - 73	--	--	--	<50		

Note: For sampling locations, see Figure 4-1 in Section 4.0.
Sources: EPA, 1980. Water Quality Criteria. Federal Register 45:79318-79379. November 28, 1980.
EPA, 1976. Quality Criteria for Water.
—, ND: Not detected.
(+6): Hexavalent chromium.
est: No chronic toxicity data available. Chronic toxicity value was estimated.

Table 10 continued

with concomitant enhancement of the eutrophication process in the Red Lion Marsh. Dissolved oxygen deficiency can limit the ecological community in a marsh. Reconnaissance assessment of Red Lion Creek Marsh indicates that the landfill has not had a significant, visible, ecological impact on the marsh. The reconnaissance assessment reports by aquatic and terrestrial ecologists are provided in Appendix N of the RI/FS.

A draft Site Inspection Report (U.S. EPA TDD No. F3-8212-09) prepared by the NUS Region III Field Investigation Team (FIT) for EPA was reviewed for this RI because the report contained information and data from samples of the leachate discharge into Red Lion Creek that were taken in October, 1982, prior to the RI/FS Investigation. The report mentions bioassay tests were performed in the leachate and Red Lion Creek using Fathead minnows and Daphnia ("leachate...presumably from the Tybouts Corner Landfill..." and from a "free-flowing section of Red Lion Creek adjacent to Route 13 bridge..."). The report indicates the results of testing were inconclusive since mortality rates of test animals may have been caused by low levels of dissolved oxygen, by presence of toxic pollutants, or by abnormally high levels of naturally-occurring chemicals. The chemical analytical results from leachate at this location indicates no significant input of priority pollutants near the Route 13 bridge, although significant levels of lead and iron were found in sediment samples near the landfill leachate, paralleling results in the RI. The sediment data near the leachate indicate that chromium, cadmium, lead and zinc concentrations do not exceed the reported toxicity values.

The State of Delaware performed chemical analysis on fish from the Route 13 bridge area on Red Lion Creek on May 31, 1983. The location of sampling is presumed to be upstream from the point where the leachate discharge in Red Lion Creek is located. Twelve white perch and three brown bullhead were collected at the Route 13 bridge. The analysis reports 1.3 micrograms per gram PCB and 0.1 micrograms per gram chlorobenzene in the composite white perch samples. The composite brown bullhead samples yielded 0.35 micrograms per gram PCBs, and no chlorobenzenes were detected. The levels detected are below the FDA standards for consumption of fish. The analysis indicated no evidence of other purgable organics, although the data sheets note that all data is qualitative or semiquantitative. Since PCBs are not a contaminant detected at Tybouts Landfill, and chlorobenzene is not detected in Red Lion Creek near Tybouts Landfill, the origin of these chemicals in the fish is not considered to be Tybouts. The origin of these contaminants could be other industrial facilities which border Red Lion Creek downstream closer to the Delaware River.

ALTERNATIVE EVALUATION

Objectives

The objectives to be achieved by the selected remedial action are:

1. to eliminate or appreciably reduce vertical infiltration of rainfall through the main and west fill areas;

2. to eliminate or control lateral migration of ground water into the main and west fill areas; and

3. to eliminate or control the contaminated ground water presently in the Columbia Aquifer and the UHZ of the Potomac.

Accomplishment of the first two objectives of remedial action at Tybouts, in combination, will severely reduce or completely eliminate the production of contaminated leachate coming from the fill materials and entering the ground water aquifers (source control).

This source control is accomplished in two ways. A cap over the landfill will prevent rainfall from entering the fill vertically and generating leachate. A ground water diversion system will prevent lateral flow of ground water through the fill.

The third objective will be accomplished by installing and operating a system of wells to pump out the existing contaminated ground water plume in the Potomac No. 1 sand. The contaminated water will be treated, either onsite or offsite, to remove the hazardous materials. Monitoring of ground water quality will ensure that contamination does not migrate into usable portions of the aquifer.

Review of Alternatives

The following section describes the alternatives reviewed in the Feasibility Study, which are divided into four groups:

A. No Action Alternative
B. West Fill Alternatives
C. Main Fill Alternatives (includes surface cap, ground water diversion and excavation)
D. Offsite ground water Alternatives

A. No Action Alternative

The FS examined the no-action alternative for both landfills, surface waters, sediment, the Columbia Aquifer, and the Potomac Aquifer. A monitoring program would be implemented to detect further migration of contaminants.

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The no-action alternative for the main and west landfill sources of contamination would result in continued uncontrolled releases of hazardous chemical compounds to the major, regional aquifer; and in continued discharges of leachate to the streams and wetlands around the site.

This alternative is unacceptable because it would not meet the goals of CERCLA and would not comply with other environmental regulations.

B. West Fill Alternatives

B1) West Fill Surface Cap, Ground Water Barrier, Pump, and Treat (Encapsulation)

This alternative involves surrounding the site with a ground water barrier, such as a slurry wall or sheet pile wall, to prevent lateral ground water flow through the landfill, and installing a surface cap and gas venting system to prevent surface water infiltration. These two actions will essentially isolate the landfill; however, since there may be some leakage through the barrier and the cap, a pump will be installed in the fill to pump out excess water. This water will have to be treated onsite or disposed of properly offsite. Figure 8 is a conceptual diagram of the cap, barrier, pump and treatment alternative as applied to the west landfill.

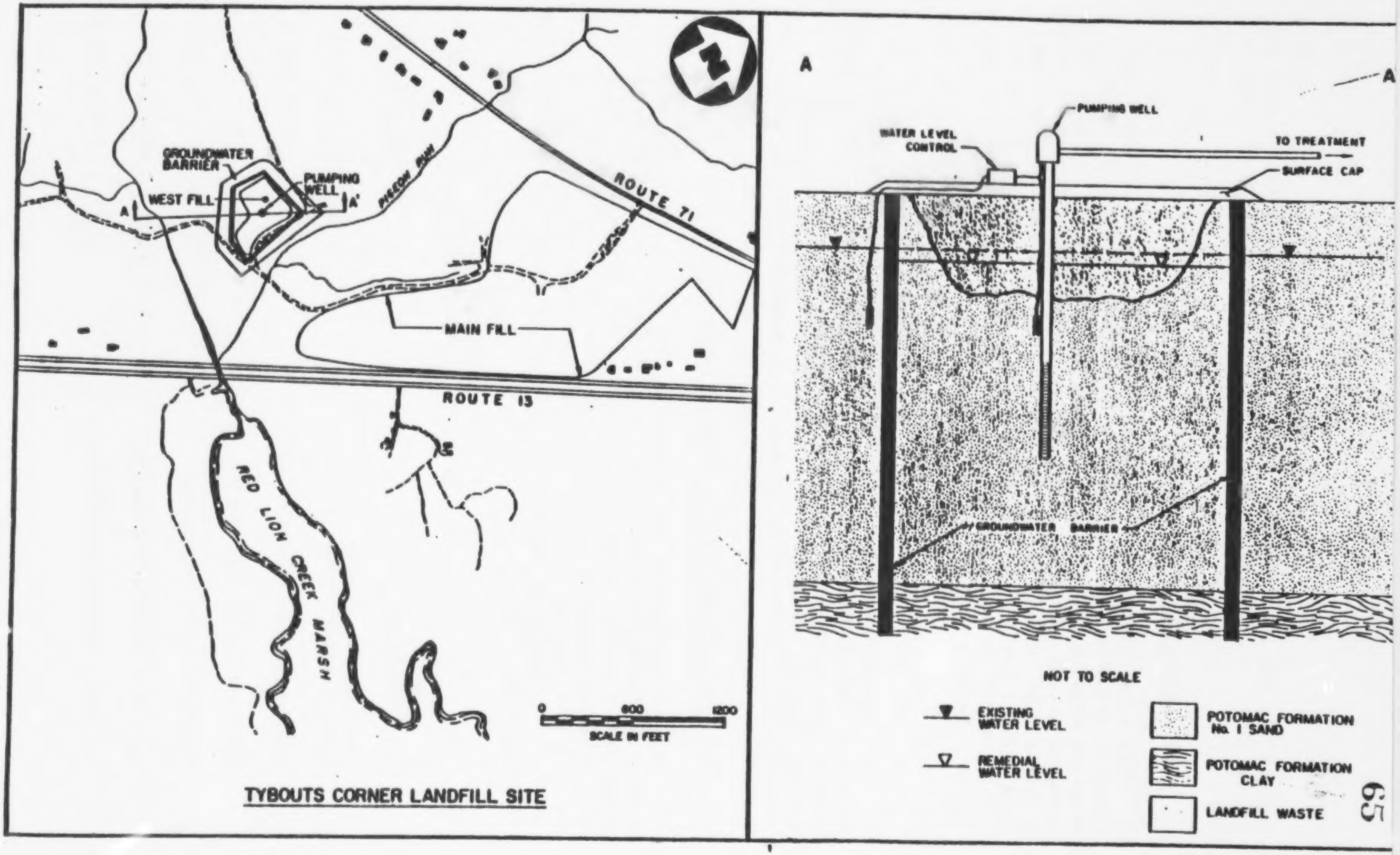
B2) Excavate West Fill, Place on Main Landfill

Excavation and removal of the contaminated waste of the west landfill is proposed as a method to mitigate the source of ground water contamination. The depth of excavation required for this landfill is 30-35 feet, and the volume to be excavated is approximately 63,000 cubic yards. The exact vertical and horizontal boundaries of the excavation will be determined in the design stage and will be based on a site-specific chemical fate and transport analysis. Backfilling with clean soils will be required for all excavate west fill options.

B3) Excavate West Fill, place in RCRA Landfill Onsite

This alternative conisders excavation of the west landfill and disposal in a RCRA landfill constructed onsite. If only the west fill were placed in a RCRA fill the dimensions of the required fill are 300 feet x 340 feet x 20 feet high. If the main landfill is excavated and placed in an onsite RCRA fill, a much larger landfill is necessary and of course the west landfill will be placed in the same RCRA landfill.

A preliminary design of an onsite RCRA landfill was prepared for the proposed excavation. Landfill design criteria used are the Resources Conservation and Recovery Act (RCRA) Subtitle C (40 CFR Part 265)



TYBOUTS CORNER LANDFILL SITE

CONCEPTUAL DIAGRAM - WEST LANDFILL
SURFACE CAP, GROUNDWATER BARRIER, PUMP, AND TREAT
TYBOUTS CORNER LANDFILL SITE, NEW CASTLE CO, DE

Figure 8

regulations and the 1984 RCRA reauthorization amendments for caps and double liners. An example of RCRA landfill construction is shown on Figure 9.

B4) Excavate West Fill, Offsite Disposal

This alternative considers excavation and offsite disposal west landfill excavated wastes. Hauling waste to some existing offsite disposal area is technically feasible, provided that a facility can be found to accept the waste. The offsite disposal facility would comply with EPA RCRA regulations, including the proposed amendment for the RCRA cap and double liner. Unfortunately, there are very few such facilities operating at this time, and the cost for disposal at such a facility is very high.

B5) Excavate West Fill, Onsite Incineration

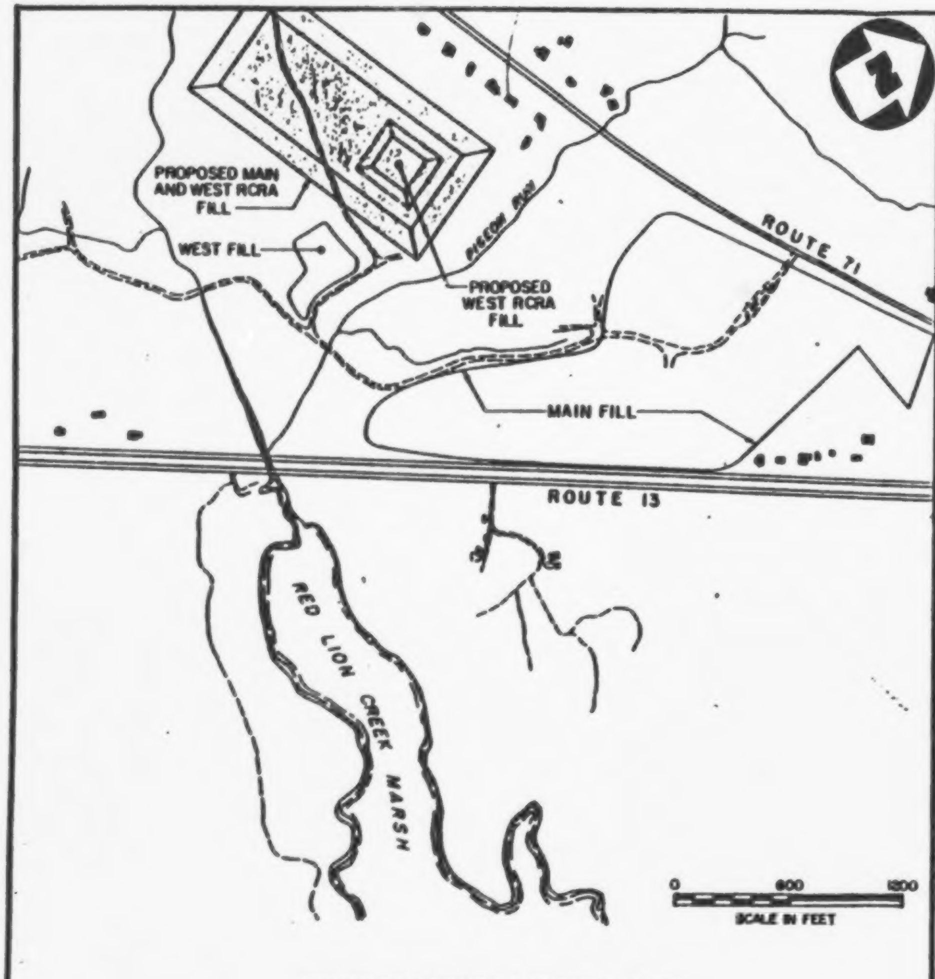
This alternative considers excavation and onsite incineration of excavated west landfill wastes. This disposal method involves construction of one or more rotary kiln incineration units onsite. Mobile incinerators are not being considered due to their limited capacity and limited availability. Incinerator residues will.require either onsite or offsite disposal.

B6) Excavate West Fill, Offsite Incineration

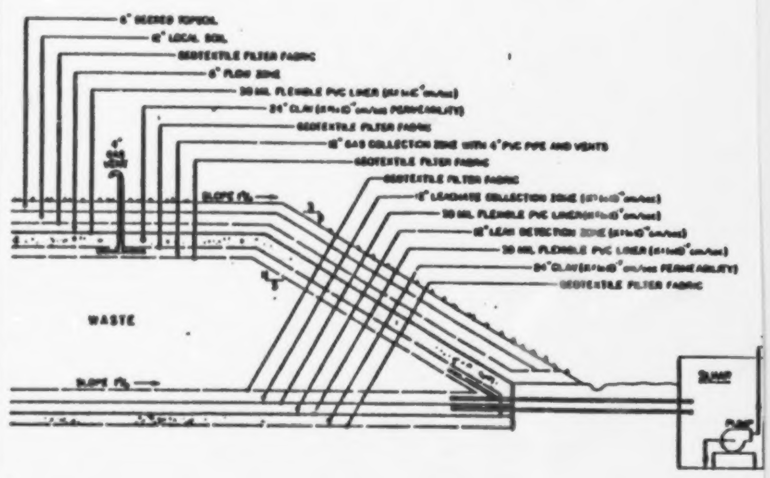
This alternative involves transporting the waste to an existing, permitted incineration facility for treatment. The use of an offsite commercial facility is unlikely at this time. Potential facilities have only limited treatment capacities and presently have a large backlog of wastes. The estimated 63,000 cubic yards volume of waste in the west landfill at Tybouts greatly exceeds the annual capacity of the typical commercial facility.

SUMMARY TABLE
WEST FILL ALTERNATIVES

Alternative	Cost (Million) $
Surface Cap, Ground Water Barrier, Pump	5.[illegible] to 11.7
Excavate, Place on Main Fill	2.5 to 3.8
Excavate, RCRA Fill Onsite	6.5
Excavate, Offsite Disposal	15.2 to 16.5
Excavate, Incinerate Onsite	20.4 to 21.9
Excavate, Incinerate Offsite	40.8 to 45.8



TYBOUTS CORNER LANDFILL SITE



TYPICAL RCRA LANDFILL CROSS SECTION

NOT TO SCALE

MATERIALS EXCAVATED FROM	VOLUME OF FILL	BASE LENGTH	BASE WIDTH	BAS
MAIN AND WEST FILLS	1,207,111 CU. YD.	1500'	700'	
WEST FILL ONLY	52,444 CU. YD.	340'	300'	

RCRA FILL SIZES

LOCATIONS AND CROSS SECTION OF PROPOSED RCRA FILLS
TYBOUTS CORNER LANDFILL SITE, NEW CASTLE CO, DE

Figure 9

C. Main Fill Alternatives

Source Control Capping

Several types of surface caps were evaluated in the initial screening to determine which cap was most effective in reducing surface infiltration, and subsequent leachate generation, in the main and west landfills. Each of the caps analyzed would required a gas venting system, a surface drainage layer, and topsoil layer. The types of surface caps analyzed include:

C1) 10^{-6} Surface Cap

- A surface cap with a thickness of two feet and a permeability of 10^{-6} centimeters per second (cm/sec). Soil materials that typically have compacted permeability of 10^{-6} cm/sec would include silt, clayey silt, and sandy clay.

C2) 10^{-7} Surface Cap

- A surface cap with a thickness of two feet and a permeability of 10^{-7} cm/sec. Materials for construction would include clay, silty clay, and clayey silt.

C3) Multi-layer Surface Cap

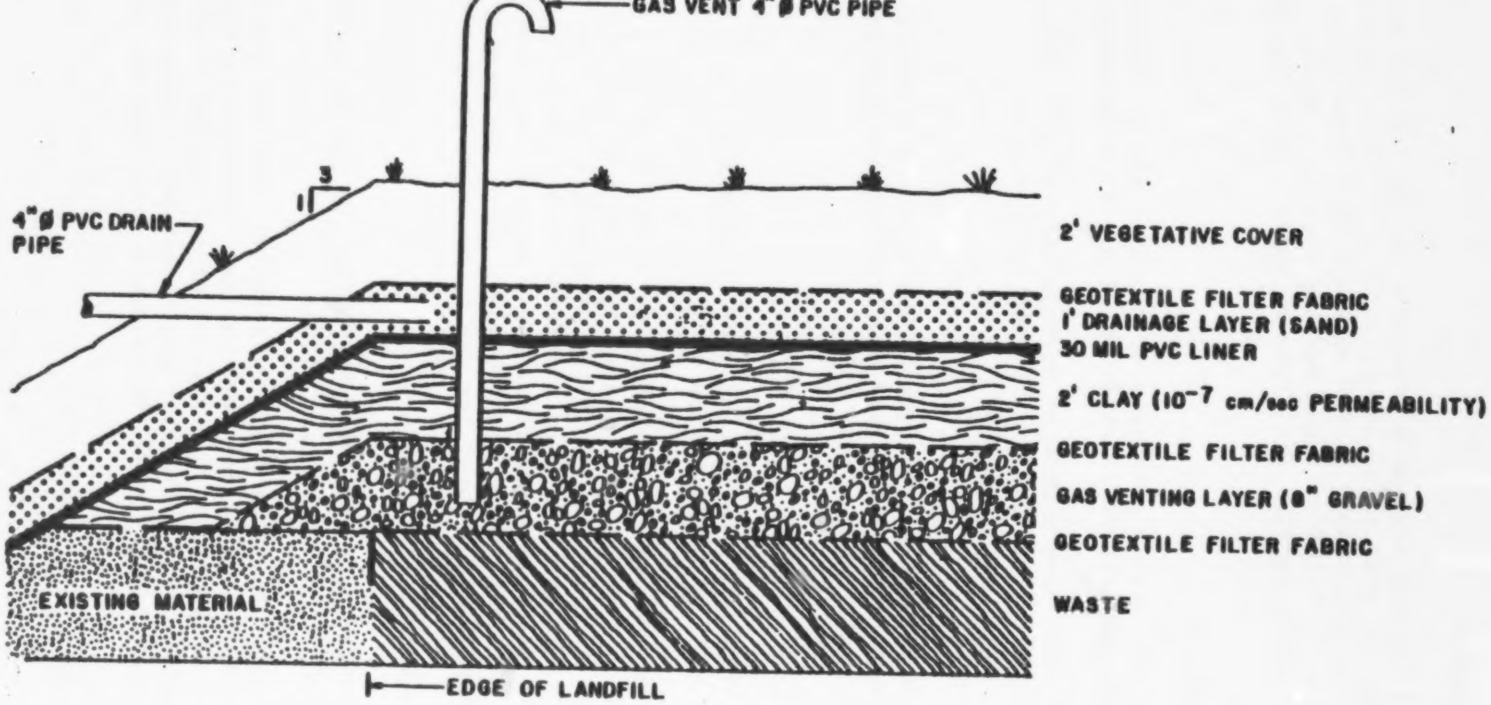
- A surface cap designed to RCRA closure requirements so that a minimum amount of infiltration occurs.

The multi-layer cap design is considered to be the best design to minimize surface infiltration into the landfills. One possible design incorporates a double liner system consisting of a 30 mil PVC membrane over a two foot thick soil layer, which will be compacted to a permeability no greater than 10^{-6} cm/sec. The design also provides for a gas-venting layer beneath the double liner and a protective vegetative cover above the double liner. A typical cross-section of this proposed cap design is shown in Figure 10.

Source Control Ground Water Diversion

C4) Main Fill Surface Cap and Subsurface Drain in the Columbia Formation (with or without Ground Water Barrier)

The surface cap and subsurface drain alternative involves placing an impermeable multi-layer surface cap over the main landfill to eliminate or appreciably reduce the vertical infiltration of precipitation through the fill, and construction of a subsurface drain that would intercept ground water that moves laterally from the Columbia Formation into the



PROPOSED RCRA CAP
TYBOUTS CORNER LANDFILL, NEW CASTLE CO., DE
NOT TO SCALE

NUS CORPORATION
A Halliburton Company

Figure 10

fill. A ground water barrier, used in conjunction with the drain, could be used to increase the efficiency of the drain. Figure 11 shows the surface cap/subsurface drain (with or without ground water barrier) alternative, as applied to the main landfill.

The subsurface drain considered for this feasibility study includes a perforated pipe system constructed in the Columbia Formation along the eastern and northern boundaries of the landfill as shown on Figure 11. The subsurface drain would be constructed in the natural sand and gravel materials along the perimeter of the landfill and would extend below the elevation of the base of the fill, into the Merchantville Formation. The subsurface drain functions as a ground water sink that collects the ground water and lowers the water table on either side of the drain.

The reliability and efficiency of the drain would be increased by a ground water barrier on the landfill side of the drain. There will always be a possibility that clogging of the drain may occur by siltation or leachate. There should be a monitoring well system in the drain to determine effectiveness and repair zones. During construction, methane and other gases would enter the trench. Forced air ventilation is needed to prevent explosions.

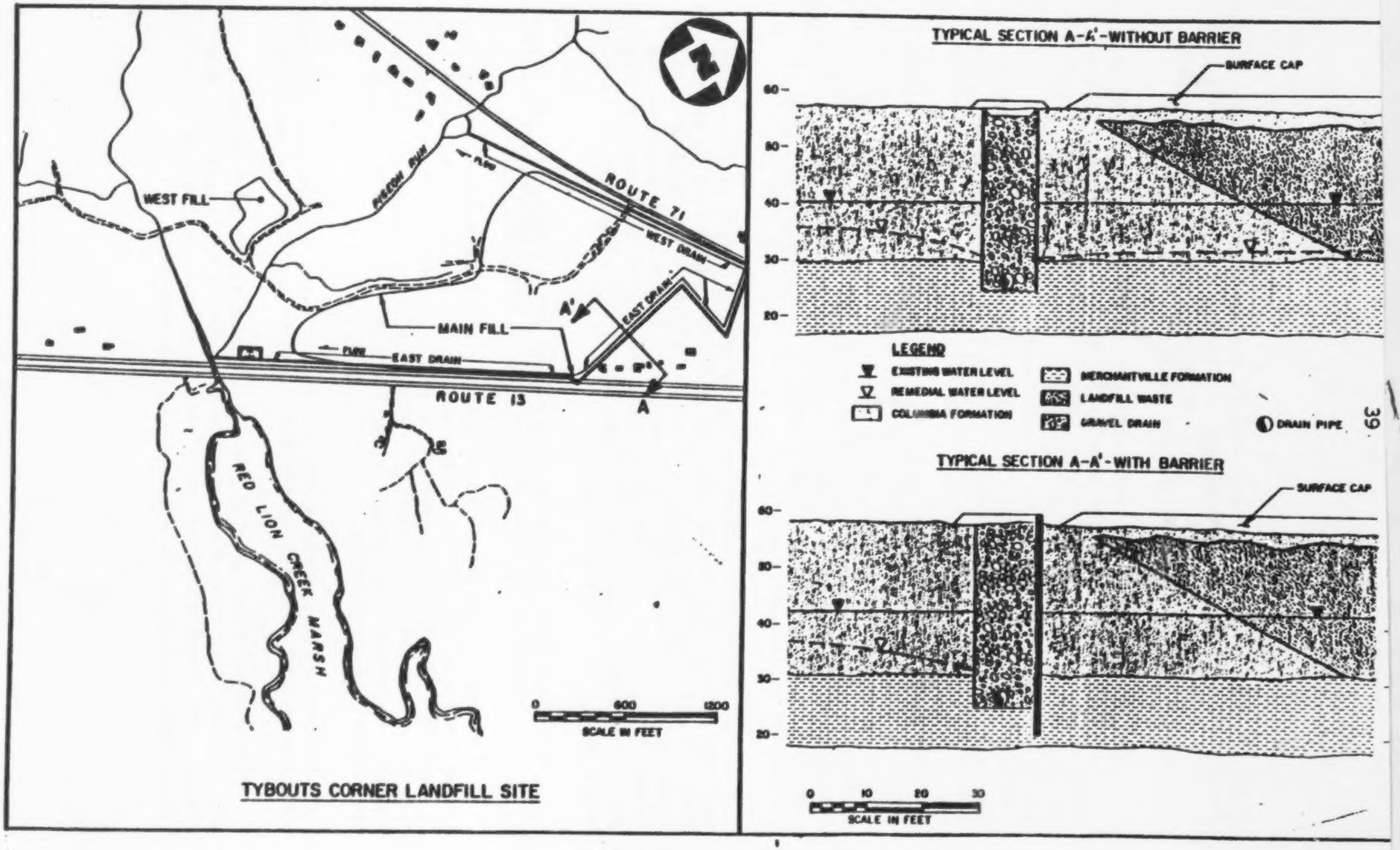
Ground water that enters the drain then enters a perforated pipe near the base of the drain, and the water is transmitted by gravity flow, to the discharge point. Since the ground water collected in the drain originates in either the landfill or contaminant plume of the Columbia Formation, the discharge from the drains will require treatment until acceptable levels are obtained at the end of the drain. Any discharge would comply with NPDES standards.

C5) Main Fill Surface Cap and Ground Water Pumping in the Columbia Formation (with or without Ground Water Barrier)

The surface cap/ground water pumping alternative is very similar to the surface cap/subsurface drain alternative, except ground water pumping is used to lower the water table and prevent ground water from migrating laterally into the main landfill. Figure 12 is a conceptual diagram showing the surface cap/ground water pumping (with or without ground water barrier) alternative.

The multi-layer surface cap and ground water barrier and treatment portions of this alternative are described in the previous sections.

The ground water pumping portion of this alternative is to continuously maintain the water table at or below the base of the landfill. The ground water pumping system would require a water collection and treatment system before discharging to the local drainage.



CONCEPTUAL DIAGRAM-MAIN LANDFILL
SURFACE CAP, SUBSURFAC IN (WITH AND WITHOUT BARRIER)
TYBOUTS CORNER LAI L SITE, NEW CASTLE CO, DE

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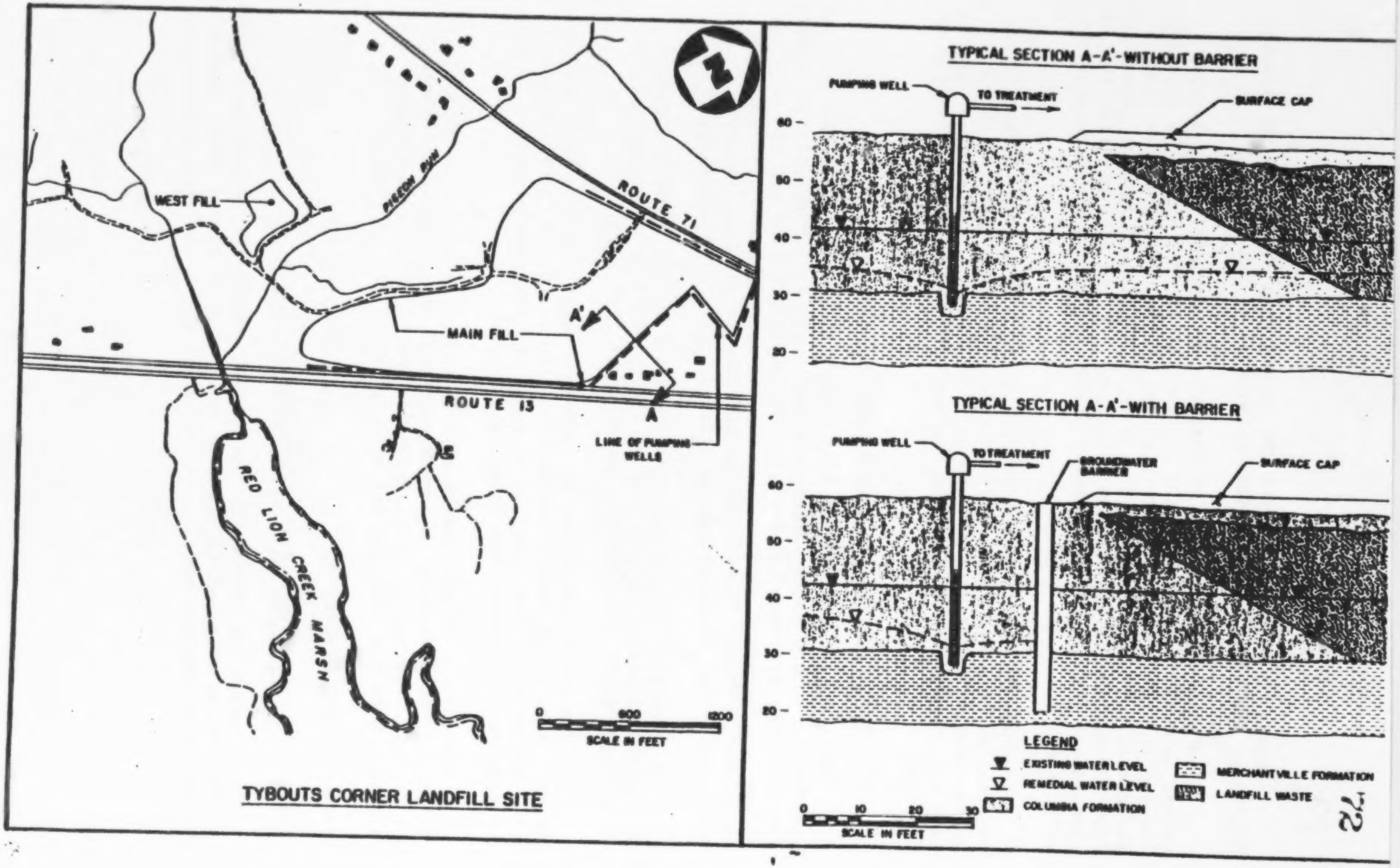
Figure 11



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CONCEPTUAL DIAGRAM
SURFACE CAP, GROUNDWATER PUMPING (WITH AND WITHOUT BARRIER)
TYBOUTS CORNER LANDFILL SITE, NEW CASTLE CO., DE

Figure 12

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Pumping in conjunction with the ground water barrier significantly increases the capability and the reliability of the system.

This alternative may not be feasible for remediation of Tybouts Corner Landfill site because the reliability of this system is directly related to the operation and maintenance of the pumping system since a failure of a pump or well would lead to resumption of lateral ground water flow through the landfill. The water level in the fill material will be immediately affected by a breakdown in the system and leachate production would resume.

Engineering design of a ground water pumping system to dewater the landfill and prevent lateral ground water flow from entering the landfill would require a more detailed design-investigation consisting of several test and observation wells along the eastern and northern perimeters of the fill.

C6) Main Fill Surface Cap/Diversion Trench

The surface cap and diversion trench alternative involves excavating a diversion trench along the eastern and northern borders of the landfill that isolates the landfill from the surrounding ground and ground water system and placing a surface cap over the main fill and side-slopes of the trench. Figure 13 is a conceptual diagram showing the surface cap/ diversion trench alternative, as applied to the main landfill.

The diversion trench would be excavated in the landfill materials to a depth either below the base of the landfill or the depth required to maintain grade for drainage, as shown on Figure 13.

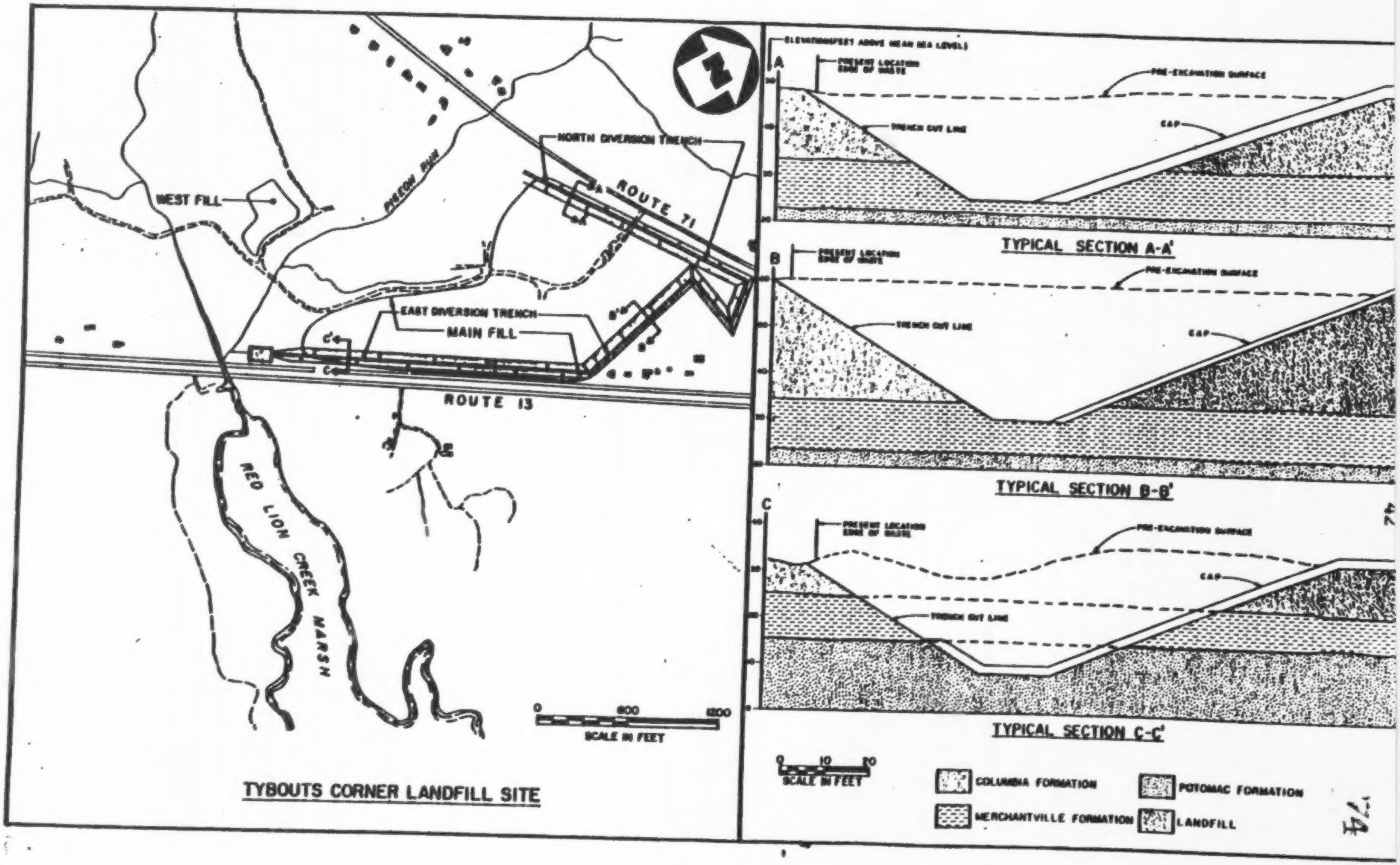
The diversion trench can be excavated using conventional methods. The main health and safety concerns are those individuals associated with excavation of the landfill to construct the open trenches. Excavation may require respiratory and dermal protection.

Construction of the trench will require provisions for controlling, collecting, and treating contaminated ground water that will enter the trench. Wastewater characteristics and the treatment required are expected to be the same for all main landfill alternatives.

Source Control Excavation

C7) Excavate Main Fill, RCRA Landfill Onsite

Excavation and removal of the contaminated waste of the main landfill is proposed as a method to mitigate the source of ground water contamination. Excavation depths are expected to be up to 36 feet in some areas of the



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CONCEPTUAL DIAGRAM-MAIN LANDFILL SURFACE CAP, DIVERSION TRENCH
TYBOUTS CORNER LANDFILL SITE, NEW CASTLE CO, DE

Figure 13

75

main landfill. Volume of excavation for the main landfill is nearly 1.5 million cubic yards; it will be assumed that, if the main landfill is excavated, the west landfill also will be excavated and disposed of in the RCRA landfill.

Excavation can be completed using conventional methods. However, large volumes of water will be generated by the excavation, and this water will require treatment. Wastewater characteristics and the treatment required are expected to be the same for the previous main landfill alternatives. Also, safety requirements will increase the time and cost for excavation. The wastes will be compacted before disposal.

Once the excavation of the waste is completed, the main landfill will be regraded to avoid ponding water. The west landfill will require a deep excavation to remove the waste, and regrading will not be possible. The west landfill will require backfill with clean soils. Both areas will be revegetated when work has been completed. The location of the proposed RCRA landfill, and a typical cross-section are shown previously in Figure 9.

C8) Excavate Main Fill, Offsite Disposal

This alternative is similar to Excavate Onsite Disposal since it involves excavation of the main and west landfill but presents another option for disposal. Here the excavated waste material would be loaded into trucks and hauled to a permitted hazardous waste landfill for disposal.

C9) Excavate Main Fill, Onsite Incineration

This alternative would involve excavation of both the main and west landfills, with onsite incineration as an option for disposal.

This disposal method involves construction of one or more rotary kiln incineration units onsite. Mobile incineration is not being considered due to limited capacity and limited availability.

A rotary kiln incinerator would decontaminate the wastes by burning at a temperature in excess of 2,000°F. By-products of incineration are gases and noncombustible particulate matter (which is removed by an air pollution control device) and bottom ash and fly ash. The bottom ash and fly ash, approximately 20 percent of the original volume of waste, will probably be considered hazardous, and will have to be disposed in a secure RCRA landfill.

The large volume of waste makes this a very costly and time-consuming alternative. It is estimated that a large capacity rotary kiln (50 million BTU/hr) can incinerate approximately 7,000 lb/hr. At this rate it would take 65 years to incinerate the entire landfill using only one incinerator. In order to maintain a reasonable time frame, the number of incinerators must be increased.

C10) Excavate Main Fill, Offsite Incineration

This disposal method involves hauling the excavated wastes to an offsite permitted incineration facility. Since this is such an unlikely possibility, no costs have been calculated.

SUMMARY TABLE
MAIN FILL ALTERNATIVE

Alternative	*Cost (Millions) &
Surface Cap, Subsurface Drainage (with and without a ground water barrier)	35.8 to 69.0 with barrier 32.9 to 64.4 without barrier
Surface Cap, Ground Water Pumping (with and without a ground water barrier)	18.1 to 54.9
Surface Cap, Diversion Trench	34.2 to 70.9 (both fills)
Excavate, RCRA Landfill Onsite	53.6 (both fills)
Excavate, Offsite Disposal	246.7 (both fills)
Excavate, Onsite Incineration	370.7 (both fills)
Excavate, Offsite Incineration	---

* The costs of these alternatives includes the multi-layer cap over the main fill area after consolidation of the west and main fills. Also, the treatment system is included for an onsite facility which will remove contaminants from the ground water and will discharge water in technical compliance with NPDES standards.

D. Offsite Ground Water Management Alternatives

D1) One Pumping Well at OR-6A

This aquifer remediation alternative involves establishing a production well for water supply use by Texaco Marketing and Refining Company using the present well at the location of well OR-6A. The location is approximately 3000 feet away and on the southern side of Red Lion Creek from the site. Texaco would use the water for their operations.

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Pumping of a production well at location OR-6A would draw contaminants to the well where Texaco would mix the water with water from other wells for use in their facilities.

This alternative will cause accelerated degradation of water quality further and deeper in the UHZ than currently exists. Ground water use restrictions will be imposed between Well OR-6A and the contaminant plume.

Also, because of the layering of sand and clay lenses in the UHZ, there may be areas of the plume which will not be drawn to the production well.

Ground water contamination could reach this production well within five years and will require continuous pumping for an extended period of time, possibly 20 to 30 years.

A long term monitoring program consisting of periodic sampling and analysis for organic compounds should be implemented if the well is used for production. Monitoring on a quarterly basis should be sufficient to detect plume interception.

D2) Two Pumping Wells for Contaminant Plume Remediation and Water Resource Recovery (West and Main Landfills)

This alternative involves installation of two new production wells that will be used to collect the contaminant plumes migrating from the west and main landfills. One well will be located immediately downgradient from, and slightly beyond the contaminant plume migrating from the main landfill; and the other within the contaminant plume immediately downgradient from the west landfill. Both wells will be be located to optimize contaminant plume collection and aquifer remediation. The location and a conceptual diagram of these wells is shown on Figure 14.

An estimate of the pumping rates and effectiveness in remediating the contaminant plumes was made using ground water modeling described in Appendix M of the RI/FS Report. Simulated pumping rates of 110,000 gallons per day for the main landfill well and about 6,000 gallons per day for the west landfill were estimated for the pumping. The actual pumping rates required may be different from these simulated rates, and actual pumping rates should be determined by a design investigation (pump test) prior to final design of a treatment system. Solute transport model simulation indicates these rates are sufficient to stop further migration of the plumes, and to collect the plume for remediation. The simulation indicates that remediation of the plume from the main landfill may take from 20 to 35 years of fairly continuous pumping.

Ground water pumped from the contaminant plume will have to be collected and treated before discharge to local surface waters. Technical compliance with all environmental laws will be maintained.

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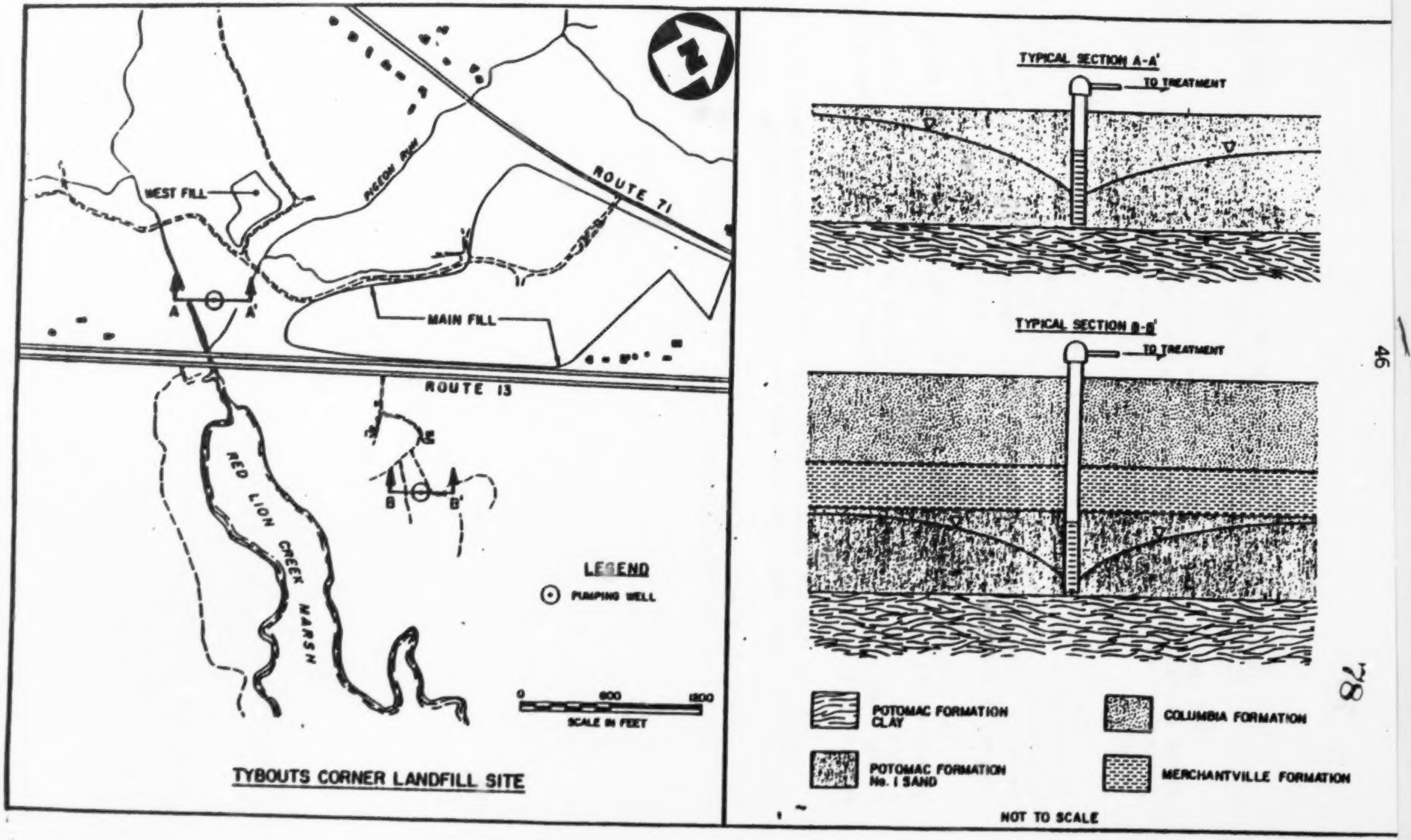


CONCEPTUAL DIAGRAM-MAIN AND WEST LANDFILLS
CONTAMINANT PLUME INTERCEPTION AND REMEDIATION
TYBOUTS CORNER LANDFILL SITE, NEW CASTLE CO.

NUS

Figure 14

D3) Three pumping wells for the Main Landfill Plume: One Pumping Well for the West Landfill Plume.

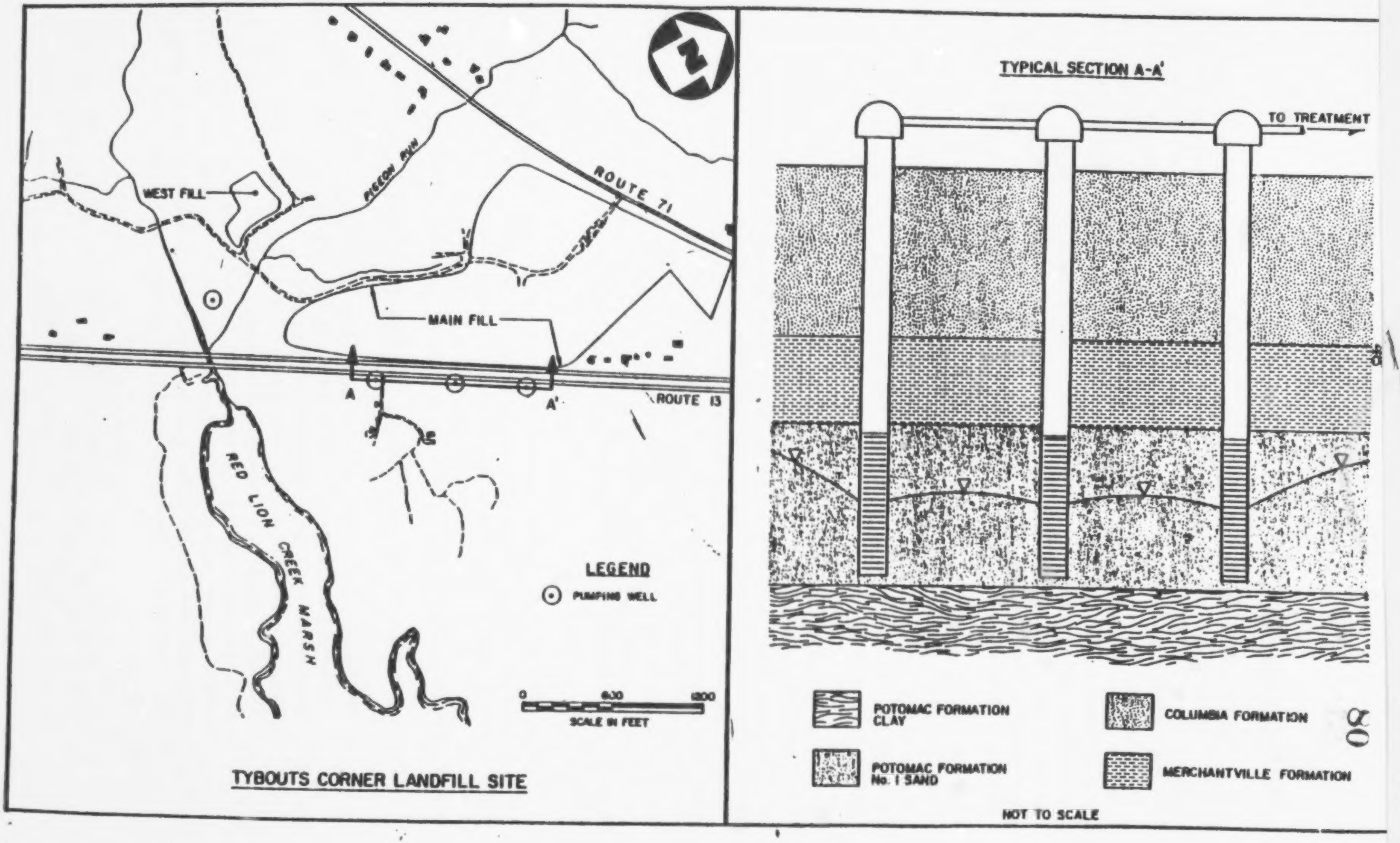
The three well system for the main landfill consists of placing three wells close to the landfill, within the contaminant plume. The three well alternative was evaluated for comparison to the installation of one well to collect the plume from the main landfill.

The three-well system involves pumping and treating the aquifer until contaminants derived from the landfill are removed to levels that are acceptable. Pumping wells are located in the plume so that only contaminated water is removed for treatment. Contaminanted ground water pumped from the wells must be treated and discharged as previously discussed.

The pumping rates for the three wells were estimated by using the ground water model discussed in Appendix M of the RI/FS report. The simulated, combined pumping rate was 33,800 gallons per day. The estimated computer simulated time required for aquifer remediation is between 40 and 100 years.

The one pumping well to intercept and remediate the west fill plume is the same well described for the west fill in Section D2.

Figure 15 shows the estimated location and a conceptual diagram for the three-well system alternative.



CONCEPTUAL DIAGRAM - MAIN LANDFILL
CONTAMINANT PLUME INTERCEPTION AND REMEDIATION
TYBOUTS CORNER LANDFILL SITE, NEW CASTLE CO, DE

NUS CORPORATION

Figure 15

RECOMMENDED ALTERNATIVE

Section 300.68(j) of the National Contingency Plan (NCP) states that the appropriate extent of remedy shall be determined by the lead agency's selection of the remedial alternative which the agency determines is cost effective (i.e., the lowest cost alternative that is technologically feasible and reliable) and which effectively mitigates and minimizes damage to and provides adequate protection of public health, welfare and the environment. In selecting a remedial alternative EPA considers all environmental laws that are applicable and relevant. Based of our evaluation of the proposed alternatives, the responsible party evaluation of alternatives, the public comments and the information received from the Delaware Department of Environmental Control, we recommend the following.

The alternative for source control selected here is B2 in combination with a variation of Alternative C4, the Main Fill Surface Cap and Subsurface Drain in the Columbia Formation. The multi-layer cap which complies with RCRA standards will be used. The difference from the alternative described in the FS is the location and length of the subsurface drains.

The basis for acceptance of the alternative is how effectively it can lower the water table in the fill. As part of the Feasibility Study, the U.S. Geological Survey (USGS) three-dimensional, finite-difference model developed by McDonald & Harbaugh was used to represent what the three-dimensional effects would be. The proposed conceptual design of the subsurface drains consists of an upgradient interceptor subsurface drain and a downgradient contaminated ground water control subsurface drain as shown on Figure 16. Design modeling showed that it could effectively lower the water table within the landfill. More detailed information about the ground water modeling can be obtained in Volume V of the RI/FS report.

The alternative selected for the offsite ground water contamination is some variation of D2 or D3, pumping wells for the main landfill and for the west landfill. However the exact number of wells, location and pumping rates will be determined by a design investigation. Figure 17 shows possible locations of the ground water recovery wells.

The specifics of the recommended alternative are:

1) The west fill will be excavated and consolidated with the main fill. Excavation will include all municipal and industrial wastes as well as contaminated subsoils. The amount of contaminated subsoil to be removed will be based on a site specific chemical fate and transport analysis. This analysis will be conducted to ensure that no soil remains in place which could cause ground water contamination to exceed the standards established in this Record of Decision. The excavated area will be backfilled with suitable clean fill material.

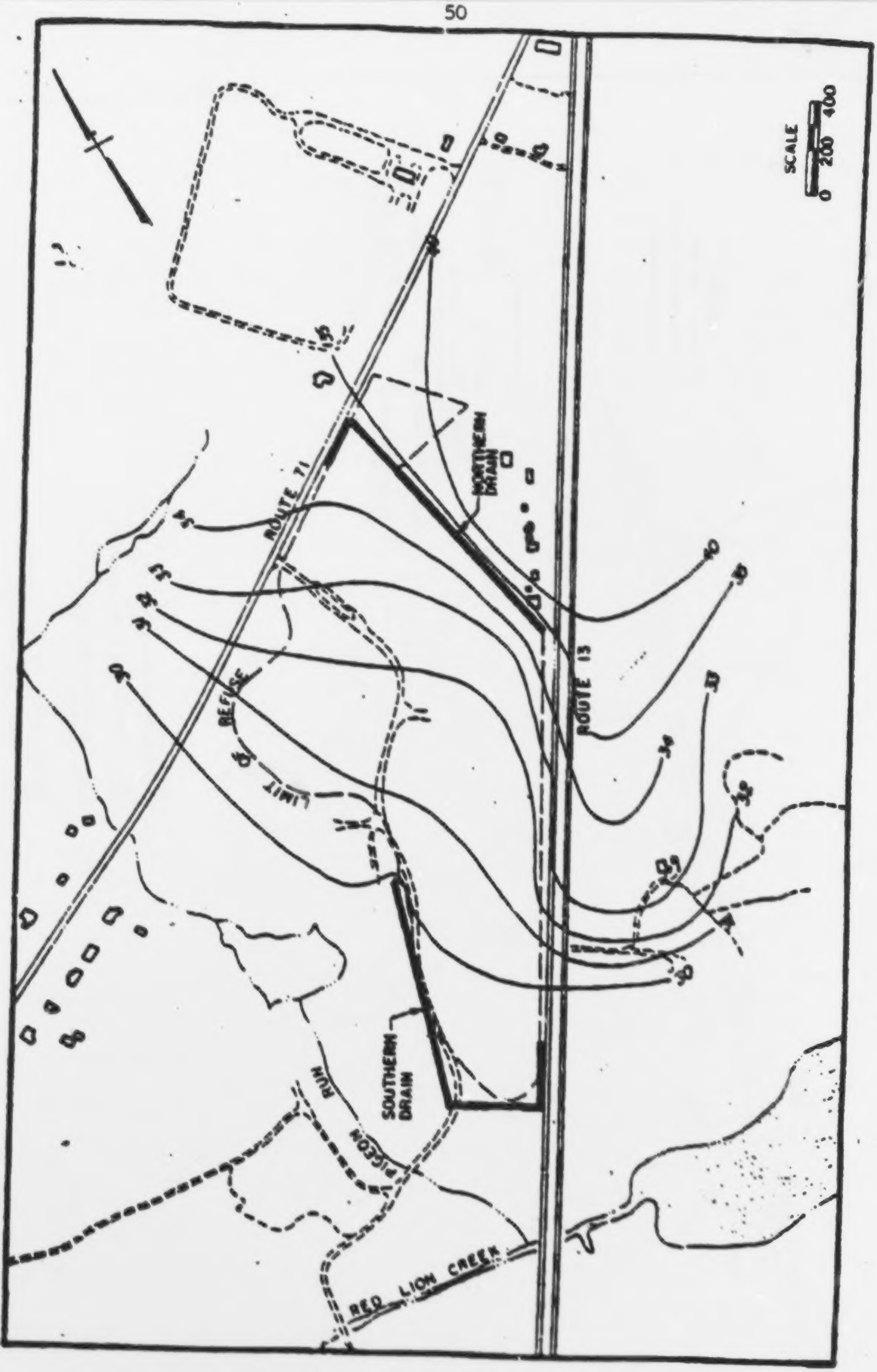


DIAGRAM 2

Figure 16

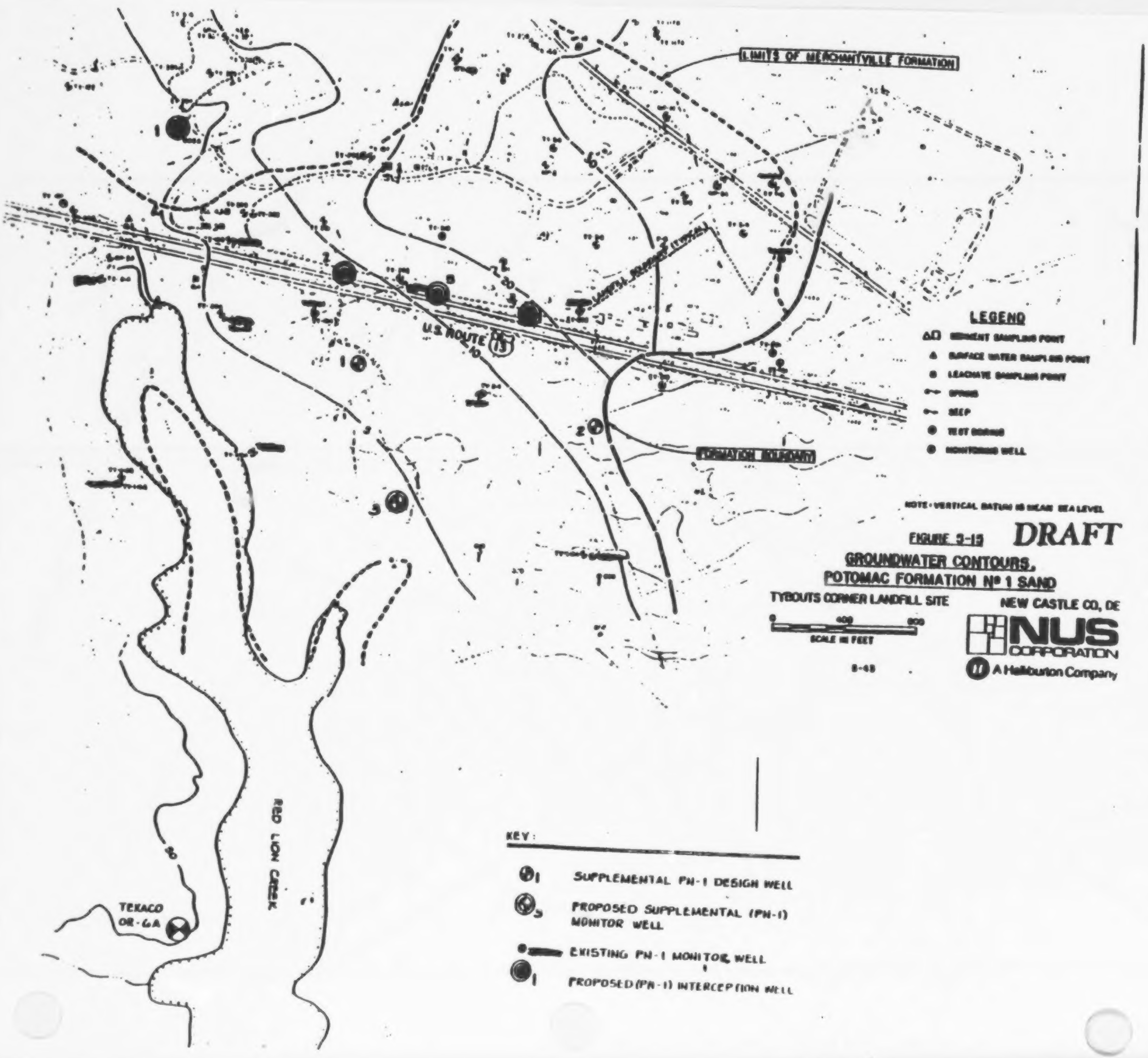

LIMITS OF MERCHANTVILLE FORMATION
FORMATION BOUNDARY
U.S. ROUTE 13
RED LION CREEK
TEXACO
OR-6A
LEGEND
SEDIMENT SAMPLING POINT
SURFACE WATER SAMPLING POINT
LEACHATE SAMPLING POINT
SPRING
SEEP
TEST BORING
MONITORING WELL
NOTE: VERTICAL DATUM IS MEAN SEA LEVEL
FIGURE 3-15
DRAFT
GROUNDWATER CONTOURS,
POTOMAC FORMATION Nº 1 SAND
TYBOUTS CORNER LANDFILL SITE
NEW CASTLE CO, DE
0
400
800
SCALE IN FEET
NUS CORPORATION
A Halliburton Company
KEY:
SUPPLEMENTAL PN-1 DESIGN WELL
PROPOSED SUPPLEMENTAL (PN-1) MONITOR WELL
EXISTING PN-1 MONITOR WELL
PROPOSED (PN-1) INTERCEPTION WELL

Figure 17

2) A multi-layered cap that complies with RCRA will be placed over the consolidated main fill area to significantly reduce or eliminate the vertical infiltration of precipitation.

3) A subsurface drain or trench system will be installed to prohibit continued lateral migration of ground water through the fill and to collect existing leachate from the fill. The multi-layered cap and the subsurface drain/trench system together are intended to dewater the consolidated fill. This ground water diversion system and multi-layered cap will be maintained until they are no longer needed.

4) The offsite plume of contaminated ground water in the Upper Hydrologic Zone (UHZ) of the Potomac will be pumped and treated or otherwise disposed of, either onsite or offsite. During the pumping institutional controls to restrict use of the ground water will be utilized.

The goal of the offsite ground water pumping will be to reduce the level of contaminants to 100 ppb of total volatile organics with separate standards for the following cancer-causing contaminants where MCL's are available. The levels for these specific substances are listed here.

Vinyl chloride	1.0 ppb
Benzene	5.0 ppb
1,2-Dichloroethane	5.0 ppb

These standards are anticipated to meet the goal of a 10^{-4} cancer risk at the boundary of the landfill property.

Ground water will be pumped for a minimum of three years, at which time pumping will be discontinued if contaminant levels have been reduced to standards set above. If the standards are not reached, pumping will continue for another three years. If after that time the standards have not been met but pumping has achieved substantial compliance with the standards and the levels of contaminants are constant in each well, pumping will be discontinued. If not, pumping will continue for another four years. If after the ten-year pumping period, standards have still not been met, EPA will evaluate the technical feasibility of meeting the standards and set new ones if necessary. Pumping may be terminated if it is shown that no reasonable modification of the pumping system or additional years of pumping would produce significant improvement.

EPA will then examine the need for additional monitoring locations to assure that the influence of any offsite production well will not affect the remaining contaminated ground water from Tybouts Corner Landfill.

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The offsite contaminant plume in the Columbia Aquifer will be allowed to flush itself clean. Once the source control is in place, no further contamination will enter the Columbia Aquifer and we predict that it could take between 10 to 15 years for all of the water that is contaminated to pass through the aquifer and seep into the Red Lion Creek Marsh. In the area of contaminated ground water, the Columbia is not hydraulically connected to the Potomac and the pumping of the Potomac should not influence the path of the Columbia contaminant plume.

5) Contaminated water generated by excavation, construction, subsurface drainage system collection and ground water pumping will either be sent to a local sewage treatment plant offsite, or treated onsite. It is possible that a combination of these two treatment systems and locations will be used. All treated water will meet NPDES standards before disposal to surface waters, including any pre-treatment requirements id the local sewage treatment plant is utilized. All waters will be disposed of in compliance with local, state and federal law.

6) A health and safety plan will be implemented for all activities described in this Record of Decision. During excavation and construction activities, air monitoring will be conducted to ensure the safety of the onsite workers as well as to protect the residents living nearby the excavation areas.

7) A monitoring program will be established to ensure that ground water quality, surface water quality, the multi-layer cap and air quality are maintained.

Operation and Maintenance

Operation and maintainance will consist of maintaining the effectiveness of the RCRA cap, maintaining the subsurface drain system to prevent clogging up or overflow, and maintaining the pumps from the drains to the treatment system. If an onsite treatment plant is constructed operation and maintenance will include the treatment system and proper disposal of contaminants.

Long term monitoring of the offsite ground water plume will be necessary to ensure the following two things:

1. that levels at the boundary do not exceed the standards after the pumping is discontinued, and;

2. that monitoring wells which are used to ensure no further spread of contamination remain uncontaminated.

If standards are exceeded at the boundary or if previously clean monitoring wells become contaminated pumping and treating will be resumed.

Consistency With Other Environmental Laws

The west fill will be closed in accordance with the RCRA closure requirements of 40 CFR §264.228(1) by removing all wastes and contaminated subsoils as discussed in the description of the selected remedy.

The multi-layered surface cap will be designed and constructed in accordance with the RCRA requirements 40 CFR §264.310.

The ground water diversion system will be designed and constructed to effectively "dewater" the main landfill. During construction the contaminated water will be disposed of in compliance with all local, state and federal regulations.

The offsite ground water contaminant plume will be pumped and treated with the goal of compliance with RCRA through establishment of standards to be met at the boundary of the facility. The goal is to meet the corrective action requirements of 40 CFR §264.100.

EVALUATION OF ALTERNATIVES NOT SELECTED

Alternative A1 was rejected for reasons stated in the no action alternative description.

West Fill Alternatives

The Surface Cap, Ground Water Barrier and Pump alternative is technologically feasible but the costs are excessive, when we consider that the west fill is only the smallest portion of the entire site. In addition it is simply not as effective as removal. The west fill is presently in the Potomac No. 1 Sands where they are connected to the Potomac No. 2 Sands. Any breakdown in the barrier or the pumping system could allow continued migration of leachate from the west fill area.

Once the decision is made to excavate the cost effectiveness determined the choice to place the excavated material on the Main fill. The other alternatives (B3, B4, B5 and B6) were millions of dollars more.

Main Fill Alternatives

Source Control Capping Alternatives

Evaluation of the effectiveness of these three caps was based on the amount of rainfall that each cap would allow to enter the fill materials. The 10^{-6} cap (alternative C1) allows approximately 60% of the present amount of water to enter the fill (26,000 gallons per day). The 10^{-7} cap (alternative C2), allows 7% (3,000 gallons per day) and the multi-layer cap (alternative C3) allows 2% (800 gallons per day).

Therefore the most effective cap will be the multi layer cap that allows the least amount of water to pass through the fill. The 10^{-6} cap and the 10^{-7} cap would allow too much water to enter the fill an create more leachate. In addition, Superfund policies require the selected alterative to be consistent with all environmental laws. In this case, compliance with RCRA closure requirements (40 CFR Part 264) require a cap that meets RCRA standards. However, there is a great deal of flexability in the design and type of materials used to construct such a cap.

Source Control Ground Water Diversion Systems

Alternative C5 consisted of dewatering the fill by ground water pumping in the Columbia Formation. This alternative was not selected because the effectiveness of the pumping is controlled by the reliability of the pumps and the wells to be pumped. Any breakdowns would allow lateral ground water flow.

Alternative C6, dependant on divertion of lateral ground water flow by open diversion trenches, was rejected for two reasons. One, the local residents had concerns about an open trench with a 40 foot drop. They felt this would become an attractive playground for local children and there would be a possibility for accidents.

The second reason is that this ground water diversion system was more expensive than the selected alternative and does not provide a significatly greater degree of protection for public health and the environment. The higher costs of this alternative are due largely to the fact that the open trench would have involved much more excavation of the landfill material, when digging out the trenches.

Alternative C7 proposed excavation of all the fill materials and placing them in a new RCRA landfill on the site. This alternative is rejected for two reasons. The location onsite is a sand and gravel pit which has been excavated to the UHZ of the Potomac. Therefore, the landfill would be built directly on the regional aquifer we are trying to protect. It is true that with proper construction, the environmental receptors could be protected. The costs of this alternative would be greater than the other effective methods.

The remaining Main Fill alternatives (C8, C9, and C10) are clearly not cost-effective since they are estimated in the hundreds of millions of dollars.

Ground Water Management Alternatives

Alternative D1, pumping at Texaco's well location OR-6A was rejected because it will cause the contamination to spread from its present distance of 400 to 800 feet from the landfill to about 3,000 feet from the fill. Organic contaminants could reach the well within 5 years. Concentrations of organic contaminants at the well are expected to be very low and possibly non-detectable, but levels between the production well and site will probably be high enough to pose a risk to human health if the water were used.

A specific treatment alternative is not selected in this Record of Decision because there are several options available for treatment which are equally effective. Offsite, a publicly owned sewage treatment plant may be available or an onsite treatment plant could be built. This Record of Decision simply establishes that treatment is necessary and that disposal will comply with local, state and federal law. Any onsite treatment system may require a treatability study prior to construction.

Responsiveness Summary

The Feasibility Study (FS) and the complete list of alternatives was presented at public meeting held July 23, 1985. Another FS meeting was held on December 18, 1985, at which EPA presented the Preferred Alternative. In response to the December meeting a petition was signed by 192 people and a response was prepared and sent out. Minutes from the meetings, the petition and response are included here.

Over all, community relations have been on going since the first meeting held in March 1983. During the course of this Remedial Investigation and Feasibility Study ten public meetings have been held. Occasionally, monthly news letters were prepared, other meetings were held with local citizens in private homes and during the water line construction an EPA representative was able to talk with most of the homeowners who were offered the connection to the public water supply.

Most of the discussion about the recommended alternative focused on the time period for remedial action. The remedial action includes maintainance of the surface cap and the ground water diversion system for as long as they are necessary and pumping related to the ground water diversion will be maintained. However, the pumping associated with the offsite ground water contaminant plume may be discontinued if the standards set by this ROD are met.

A SUMMARY OF
CITIZEN AND INTERESTED-PARTY COMMENTS AND CONCERNS
AND OF U.S. ENVIRONMENTAL PROTECTION AGENCY RESPONSES

TYBOUTS CORNER LANDFILL SITE
PUBLIC MEETING

TYBOUTS CORNER, NEW CASTLE COUNTY, DELAWARE
JULY 23, 1985

Public and Environmental Health

Issue: **The site is affecting the health of community residents and their children. A number of citizens believe the area has a high number of cancer victims; one person stated that 60 percent of the deaths in the county are from cancer. Another said he developed the disease "in 5 months." These people were certain the Tybouts Corner Landfill Site is responsible for illnesses in the area.**

Response: The air quality at the Tybouts Corner Landfill Site poses no risk to the community. Two local wells were affected by the site. The Wagner well has been abandoned, and a treatment system was connected to the Woytko well. These are the only wells affected to date. No municipal water supplies have been affected by the Tybouts Corner Landfill Site.

Issue: **Many people in the area hunt and fish near the site. Contaminated groundwater is known to be entering local surface waters. How does this contamination affect the wildlife that feeds in the area and does the contamination affect the food chain? Can people become ill from eating locally caught fish and game?**

Response: The Department of Health of the State of Delaware has sampled fish in areas proximal to the Tybouts Corner Landfill Site, and the Department of Health does not consider the fish to be a threat to human health.

Issue: **Shouldn't a health survey be conducted?**

Response: The purpose of the RI/FS is to remediate the landfill and the groundwater contamination, not to conduct a health survey.

Costs and Funding

Issue: **More importance is being given to remedial costs than to the effect the site is having on human health. No cost should be spared when human health is at stake.**

Response: All technically feasible alternatives that would utilize known and proven techniques to remediate the Tybouts Corner Landfill Site were examined without regard to costs. Costs were merely reported for each alternative. The cost effectiveness of each alternative is considered during selection of the final remedial alternative that will be implemented, but not at the expense of human health or of the environment.

Issue: **Will the potentially responsible parties (PRPs) be required to pay for cleanup? If not, where does Superfund get its money?**

Response: Yes, the PRPs are responsible for costs. Superfund money comes from the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), passed by Congress in 1980.

Technical Questions

Issue: **What is the goal of the RI/FS? Is it total cleanup?**

Response: The stated objective is to find the most cost-effective method to protect the public health and the environment from current contamination and from potential contamination.

Issue: **Have any of the options proposed for cleanup been done anywhere else?**

Response: All of the technologies evaluated during the feasibility study have been successfully utilized at other sites. However, each site is unique, and technologies that work well at one site may not be applicable at other sites.

Issue: **When can we expect construction of the final remedial action alternative to begin?**

Response: Hopefully, construction will begin by December 1986.

Issue: **What impact is the site currently having on existing wells?**

Response: Currently, the site is not affecting any municipal water supply wells. Two private wells did become contaminated; one has been abandoned, and the other is now connected to a treatment system. In addition, all local well users have been connected to the municipal water supply.

Issue: **How great an area is currently contaminated? Is it measurable in square miles?**

Response: Presently, contamination of the regional aquifer extends 400 to 800 feet east to southeast of Route 13. Contamination has also spread several hundred feet north of Route 71.

Issue: **How do you know that the Columbia Aquifer and the Potomac Aquifer are connected?**

Response: Drilling samples and logs show that the Columbia formation lies directly on top of the Potomac formation sand north and northeast of the site. One boring, located within the main landfill, showed a small area where there was no intervening, low-permeability layer between contaminated landfill materials and the Potomac formation sand.

EPA Guidelines

Issue: **How does Superfund restrict future use of the site?**

Response: The EPA will ask the county and the property owner to restrict the property deed.

Issue: **No hazardous wastes are to be moved on or off the site; yet trucks have been seen hauling sand and gravel from the site. Why doesn't anyone stop this?**

Response: Sand and gravel are not hazardous wastes.

Remedial Action Alternatives

Issue: **Isn't incineration considered to be the best way to handle hazardous waste?**

Response: Yes, it is one of the best methods, but the cost of incinerating wastes from the Tybouts Corner Landfill is estimated at $350 million.

Issue: **Wastes can be excavated and removed to offsite incinerators such as the incinerator referred to as the "Blue Goose." If this isn't possible, an incinerator can be built on site.**

Response: The use of an offsite commercial facility is not likely at this time. Approved facilities have limited treatment capacities and large backlogs of wastes. The volume of wastes at the Tybouts Corner Landfill Site is estimated to be 1.5 million cubic yards; this volume greatly exceeds the annual maximum capcity of a typical commercial facility.

Onsite incineration would be very costly and time consuming because of the large volume of wastes at this site. The estimated capacity of a large volume rotary kiln (50 million BTU/hr.) is 7,000 lb/hr. It would take 65 years, at this rate, to incinerate wastes at the Tybouts Corner Landfill Site. To achieve a reasonable schedule for remediation, several incinerators would have to be built, and the cost would be prohibitive.

Issue: **An onsite incinerator might be the best idea. When the onsite contaminated wastes are all processed, the incinerator could be used to burn waste from other sites. Using the incinerator to process wastes from other sites would provide much needed jobs and revenue for the community.**

Response: See response which directly precedes this one.

Issue: **Does incineration create an air pollution problem?**

Response: Gases and vapors generated during the incineration process are destroyed in an afterburner chamber. Byproduct gases and noncombustible materials are removed from the gas stream by at least one of the numerous air pollution control devices available on the market.

Issue: **If an onsite landfill is chosen, will it be used to dispose of any wastes other than those from the site itself?**

Response: Possibly. Superfund money would only be used for existing materials.

Issue: **If EPA decides to pump the groundwater, how long will pumping be necessary?**

Response: Depending on the pumping scheme, tentative estimates indicate that between 10 years and 100 years would be needed to cleanse the groundwater.

Issue: **What is the volume of water moving through the site each day?**

Response: The volume of leachate generated by the infiltration of precipitation into the landfill is estimated to be 43,700 gal/day. The total volume of groundwater moving through the landfill each day is estimated to be 51,000 gallons.

Remedial Action Alternatives Suggested by Citizens

Issue: **There is no need to spend money on building incinerators when God has provided volcanoes that produce enough heat to burn anything that is put into them.**

Response: The nearest active volcano within the United States is Mount St. Helens. Transporting hazardous materials would involve interstate transport and the construction of transfer stations to handle the wastes at both the point of origin and the destination. Placing the wastes into the volacano would be hazardous to workers. These factors would greatly increase the risks to the public and to the environment. The technical aspects involved, as well as the health and safety aspects and the costs, make this option infeasible at this time.

Issue: **Contaminants can be frozen in the ground.**

Response: The freezing option is commonly used on small-scale projects of short duration to facilitate engineering activities for civil engineering works. It is not a proven option for hazardous waste disposal, and containing waste materials by this method would require maintenance in perpetuity. Cost would be extremely high.

Issue: **Why not dig a core into the [center of the] earth and force all of the waste into it?**

Response: Deep disposal options have been extensively investigated and considered for high-level nuclear wastes but, at present, there are no areas of this type available for storage of hazardous wastes.

Underground disposal is not viable at the Tybouts Corner Landfill Site because of the depths to which the aquifers extend. Since there are no approved offsite facilities, this option cannot be considered for the Tybouts Corner Landfill Site at this time.

Information Repositories

Issue: **The current information repositories are inconvenient; why not establish one at the Wilmington City Library?**

Response: Fine, we will place copies of the RI/FS in the Wilmington Library.

PRELIMINARY DRAFT

MEETING SUMMARY
TYBOUTS CORNER LANDFILL SITE
TYBOUTS CORNER, NEW CASTLE COUNTY, DELAWARE
DECEMBER 18, 1985

On December 18, 1985, the U. S. Environmental Protection Agency (EPA) and the Delaware Department of Natural Resources and Environmental Control (DNREC) held a public meeting at 7:30 pm in the Gunning-Bedford Junior High School. Representing the EPA at the meeting were Ed Skernolis, Site Response Section Chief, Ann Cardinal, Region III Community Relations Coordinator, and Roy Schrock, Regional Site Project Officer. The DNREC representatives were Mike Apgar, Supervisor of the Geohydrology Branch; Bob Pickert, Environmental Engineer, CERCLA Management Branch; Gus Merganthaler, Environmental Engineer, RCRA Management Branch; and Kathy Jamison, Information Officer. Carrie Deitzel, Community Relations Specialist, attended for NUS Corporation.

The meeting was opened by Kathy Jamison who explained that the purpose of the meeting was to discuss the preferred remedial alternative for the Tybouts Corner Landfill Site. Ms. Jamison stressed that the choice of remedial alternatives was not final. Before turning the meeting over to Mr. Schrock, she told the audience that DNREC technical personnel were present. Anyone wishing to discuss technical matters after the close of the meeting was instructed to contact Ms. Jamison for referral to the appropriate person.

When Mr. Schrock took the floor, he distributed copies of the fact sheet describing the preferred remedial alternative. The fact sheet had been mailed, earlier in the month, to persons on the EPA's interested parties mailing list. Mr. Schrock then proceeded to explain the EPA's purpose for holding the public meeting. He also outlined the steps of the Superfund process remaining to be taken for the Tybouts Corner Landfill Site and reviewed the preferred remedial alternative. Mr. Schrock then announced that the public meeting marked the opening of the public comment period which would be closed on January 8, 1986. During this time, interested parties' comments and concerns would be solicited by the EPA. Following his review of the preferred remedial alternative, Mr. Schrock addressed questions from the audience.

The preferred remedial alternative described by Mr. Schrock included excavation of the west fill and consolidation of the excavated materials with those in the main fill. The resulting pit in the west fill area would then be backfilled with clean fill materials, and the consolidated waste materials on the main fill would be covered with a multi-layered RCRA cap that would reduce or eliminate vertical infiltration of precipitation into the landfill. A subsurface drain system would be installed to prevent the lateral migration of groundwater through the landfill and also to collect leachate flowing from the fill. In addition, pumping wells would be installed offsite to remediate the contaminated groundwater plume in the Upper Hydrologic Zone (UHZ) of the Potomac aquifer. These wells would be pumped for a minimum of 3 years or until a level of 100 ppb of total volatile organics is reached. Groundwater quality will be monitored, and contaminated water generated during construction of the remedial alternative will be disposed in compliance with Federal, state, and local laws. An agreement is being negotiated with the City of Wilmington, Delaware for disposal of any contaminated waters from the Tybouts Corner Landfill Site.

The question and answer period was dominated by repeated outbursts from one local resident who has a history of such behavior at several previous site-related meetings. Six other individuals also asked questions, while the other members of the audience sat quietly listening.

The most frequently expressed concern was about collected contaminated groundwater. There seemed to be confusion initially about whether the collected water would be stored or treated and, if treated, where it would be discharged. There was also concern about whether treated water could be safely discharged into local surface waters.

The subsurface drainage system also received a great deal of attention from people who wanted to know how it would be constructed, how deep it would be, and what would prevent it from overflowing during heavy rains.

Several alternative methods of handling hazardous wastes were mentioned including total excavation and offsite storage, waste recycling, and offshore incinerator ships. The latter technology was addressed by Mr. Skernolis, who informed the audience that these ships were in very limited operation in the United States and that, at this time, they were being used only for one hazardous substance, PCB. One citizen suggested that remediation technologies should not be chosen until the landfill materials were actually excavated. This would allow the technologies chosen for site remediation to be based more specifically on what was in the landfill than on what was expected to be there. This person felt that this practice would lead to more efficient and cost effective ways of dealing with wastes than the current proposed excavation, relocation, and reburial method.

Remedial expenses and who should pay them were also mentioned by several residents. More than one individual felt that the responsible parties should be required to pay not only the cost of site remediation and maintenance but also the expenses now being incurred by local citizens, such as the cost of water and a monthly assessment for fire hydrants.

Another question concerned water-treatment methods, and concern was voiced that volatile organics, volatilizing into the air during water treatment, might cause air pollution problems. Many people expressed displeasure that remedial alternative construction would not begin until late December 1986, and some people wondered if it would be necessary to evacuate residents during the construction. The length of remedial alternative maintenance was discussed, and one resident stated his lack of confidence that the proposed pumping wells could remediate the groundwater effectively. This person also asked about the interconnection of the aquifers and requested a letter from Mr. Schrock stating that there is such a connection.

Ann Cardinal called the meeting to a close when interest appeared to be flagging and questions were becoming repetitive. She stated that the EPA and DNREC representatives would remain available to discuss any additional questions with people individually. Ms. Cardinal also reminded the audience that the EPA public comment period would remain open until January 8th.

Throughout the meeting a reporter for the Wilmington News-Journal took notes. WHYY-TV and WILM-Radio also covered the event and conducted interviews with Mr. Schrock immediately after the close of the meeting.

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Mr. Leo Woytko
965 Red Lion Road
Route 71
New Castle, DE 19720

December 28, 1985

United States Environmental Protection Agency
Region III
Mr. Roy Schrock
6th and Walnut Streets
Philadelphia, Pennsylvania 19106

RE: TYBOUTS LANDFILL CLEAN-UP PROPOSAL

We, the undersigned, are located on Hamburg Road, North of the landfill and in back of Mr. Leo Woytko. We have our own ring wells which are approximately 20 feet deep.

By pumping approximately 5 million gallons per day from the landfill, leads us to be concerned about the drainage of our wells. We would like to know what can be done for us and if this plan even concerned or took into account some of the other residents like us who live near the landfill. We would like to hear from you in the very near future.

Name	Address
Mr & Mrs Harry Harrington	1043 Bear Road, N.C., DE.
Mr & Mrs James E. McCormick	1041 Bear Road, New Castle, Del.
[illegible] Cyril D. Speck	1047 Bear Rd [illegible] Del
Thelma Swift	868 Reybold Dr. N.C. De.
James M. Swift.	865 Reybold Dr. N.C. De
Charlotte L. Mitchell	1031 Bear Rd N.C. De
Walter C. Mitchell	1031 Bear Rd N.C. De.
Dorothy B. Johnson	1017 [illegible] New Castle De

Shirley Morris
Sandra Morris
Mr & Mrs Francis McDowell
862 Reybold Dr., N.C., De.
Mr & Mrs Thomas Williams Sr.
860 Reybold Dr. N.C. Del

Respectfully yours,

Leo Woytko
Leo Woytko

Laura M. Green
Aaron Souder
1078 Bear Rd, N.C.

Betty Bendler 1044 Bear Rd.

U.S. Environmental Protection Agency
Region III
6th & Walnut Streets
Philadelphia, PA 19106

Attention: Mr. Roy Schrock

Sir:

We, the undersigned, as residents of New Castle County, DE, ______________ , located near the Tybouts Corner Landfill, wish to go on record as being opposed to the "Preferred Remedial Alternative for that Landfill", also known as the "Remedial Investigation/Feasability Study", or "RI/FS", as presented by the U.S. Environmental Protection Agency recently.

The alternative, or dewatering, as listed above is not a practical or long range solution to the problem. By way of proving the above, in a similar situation, the Landfill at Llangollen, some two (2) miles north of the Tybouts Corner site, the dewatering process has been in progress for thirteen (13) years, having existed since 1972. This operation has not been successful, and is still pumping!

We also oppose the dewatering as a solution to the contamination of the Potomac acquifer at this location because of the lowering of water tables in the area of this Landfill at Tybouts Corner.

In conclusion, we oppose the "RI/FS" as proposed by the U.S. Environmental Protection agency recently at a Public Hearing in Gunning Bedford School, Delaware City, Delaware.

It is neither practical, nor efficient as a solution in the long range context, is a waste financially to the U.S. Government, and the taxpayer as well as damaging individual residential water supplies.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III

841 Chestnut Building
Philadelphia, Pennsylvania 19107

Thank you for your interest in EPA's decision making process for the cleanup solution at the Tybouts Corner Landfill site.

I have reviewed your letter concerning the objections you have made to the Preferred Alternative presented to the public on December 18, 1985. The objections appear to be based on misunderstandings of the remedy and its effect on local ground water.

The first and most important concern is for those of you who have your own private wells and fear that ground water pumping will drain your wells.

The first misunderstanding is the amount of water to be pumped. The proposal is to place the wells along the landfill side of Route 13. At most, we are intending to pump 30,000 - 40,000 gallons per day at that location and not the 5 million gallons per day indicated in your December 28, 1985 letter. This pumping is intended to affect only the ground water within 300-400 feet east of the site. There are no private wells within this area, therefore the pumping of ground water can not affect existing local residential wells.

Secondly, the subsurface drains are part of the ground water diversion system. The upgradient drain will stop water from entering the landfill by collecting the water right before it enters the fill. The remaining ground water flow will go around the landfill. "Dewater" means to take the water from the landfill itself, not all the area around the landfill. The water elevation around the landfill will remain at the same levels while the water elevation in the landfill itself will drop 25 to 30 feet. This is how we can dry out the landfill material. The subsurface drains will not affect the ground water level in local residential wells.

The third misunderstanding is the objection to EPA's preferred alternative because it is the same "solution" that was carried out at the Langollen, Army Creek Landfill site. There are several significant differences between the projects which make the comparison inappropriate. We are proposing an impermeable surface cap; only soil has been used at Army Creek. We are proposing to divert ground water around the landfill material to prevent further generation of leachate; no ground water diversion has been conducted at Army Creek. We are proposing to collect and treat the ground water contamination at the site; collection and treatment have not been carried out at Army Creek. The pumping wells at Army creek are intended only to prevent the contaminated ground water from moving any further in the ground water aquifer.

A final concern is that this project is a waste of U.S. Government funds. We expect a settlement with the group of responsible parties so that they can implement and pay for the cleanup alternative selected by EPA. It is true that your taxes will contribute to this cleanup fund because New Castle County was the operator of the facility and therefore one of the responsible parties. However, there are many other private companies which may have to share in the cleanup costs.

I have enclosed the preferred alternative for you to review once again. If there are further questions about what is written here, please feel free to call Roy Schrock at 215-597-0913 or Ann Cardinal at 215-597-9905. In addition we will plan to be available to discuss the preferred alternative with you at DNREC's new office on Grantham Lane at Route 9, south of New Castle on January 29th from 3:00 to 5:00 pm. and from 7:00 to 9:00 pm.

Sincerely,

Roy R. Schrock

Roy R. Schrock
EPA project manager

(3HW21)

RECEIVED

DEC 27 1985

Hazardous Waste Management Division
EPA - Region III

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES
& ENVIRONMENTAL CONTROL
89 KINGS HIGHWAY
P.O. BOX 1401
DOVER, DELAWARE 19903

OFFICE OF THE
SECRETARY

TELEPHONE: (302) 736 - 4403

December 13, 1985

Mr. James Seif, Regional Administrator
U. S. EPA - Region III
841 Chestnut Building
Philadelphia, PA 19107

Dear Mr. Seif:

The purpose of this letter is to inform you that the State of Delaware supports the proposed remedial alternative for the Tybouts Corner Landfill Superfund site, as described in a memorandum received by this Department on December 3, 1985.

I request that you keep me informed of your plans to hold a public meeting to explain the details of the proposed remedial alternative.

Finally, please keep me informed of your progress in negotiating the consent agreement for remedial cleanup with the responsible parties involved with the Tybouts Corner site.

If you have any questions concerning this letter, please do not hesitate to contact me directly.

Sincerely,

John E. Wilson, III
Secretary

RECEIVED

DEC 18 1985

EPA, REGION III
OFFICE OF REGIONAL ADMINISTRATOR

JEW,III:PGR:lmw
cc: Robert W. Perkins
Robert J. Touhey
Phillip G. Retallick
Stephen Wassersug, EPA Region III

Alternative Components	Costs	Public Health Considerations	Environmental Considerations	Technical Considerations	Other
A1) NO ACTION WITH MONITORING		Contamination from the landfills will continue to spread in the UHZ of the Potomac, which is a major water supply aquifer, and the Columbia aquifer.	Leachate generation will continue to discharge to surface water and ground water as a result of rainfall and ground water inflow from the Columbia aquifer.	Does not reduce vertical infiltration. Does not reduce lateral migration of Columbia through the landfill. Does not reduce contaminant plume in Columbia or Potomac aquifers.	Strict institutional controls must be applied to be sure no further well permits are issued in areas where contaminated ground water exists.
B1) WEST FILL SURFACE CAP, GROUND WATER BARRIER, PUMP AND TREAT	Capital $3.8 to $4.1 Million Present $5.2 to $11.7 Million	This alternative will effectively contain contaminated wastes and prevent further contamination of the Potomac UHZ aquifer.	Leaching of contaminated materials from the west fill will be eliminated.	Pump and treat system must maintain lower ground water level within the barrier than outside the barrier. Barrier to be be keyed into Potomac clay layer (approx. 55 ft. depth) and design investigation is needed. Treatability study should be performed. Onsite treatment will generate residuals which will require proper disposal.	To be most effective, this alternative should be used in conjunction with another main fill alternative.
B2) WEST FILL EXCAVATE, PLACE ON MAIN FILL	Capital $18 to 2.4 Million Present $2.4 to 3.7 Million	The source of hazardous waste will be removed from the Potomac formation. Some level of contaminated soils and ground water will remain.	Same as B1.	Approximately 63,000 cubic yards will be excavated. Backfilling with clean soils will be required.	Same as B1.
B3) WEST FILL EXCAVATE, RCRA FILL ONSITE	Capital $5 Million Present $6 Million	Same as B2.	Same as B1.	Same as B2.	Same as B1.
B4) WEST FILL EXCAVATE, OFF-SITE DISPOSAL	Capital $15 Million Present $16 Million	Same as B2.	Same as B1.	Same as B2.	Same as B1.

Alternative Components	Cost	Public Health Considerations	Environmental Considerations	Technical Considerations	Other
B5) WEST FILL EXCAVATE, ON-SITE INCINERATION	Capital $7.7 to $8.3 Million Present $20.4 to 21.9	Same as B2.	Same as B1.	Same as B2.	Same as B1.
B6) WEST FILL EXCAVATE, OFF-SITE INCINERATION	Costs were not estimated.	Same as B2.	Same as B1.	Same as B1.	Same as B1.
C1) SURFACE CAP 2 FT. OF SLIT PERMEABILITY OF 10^{-6} cm/sec	This alternative was suggested by PRP's and costs were not provided.	The cap alone will not stop leachate generation; contaminant plume in the ground water will remain.	The cap will eliminate some surface seepage areas. Offsite leachate seeps will continue.	This cap will allow approximately 60% of the present amt. of water to enter the fill materials. This is approximately 26,000 gallons per day. (gpd)	Any cap must be used in conjunction with ground water control alternative. Present amount of water ente ing the fill is 44,0 gpd (avg. over the year)
C2) SURFACE CAP 2 FT. OF CLAY PERMEABILITY OF 10^{-7} cm/sec	Same as C1.	Same as C1.	Same as C1.	This cap will allow approximately 7% of rainfall to enter the fill materials. This is approximately 3,000 gpd.	Same as C1.
C3) SURFACE CAP Multi-Layer	Capital 15.7 Million	Same as C1.	The cap will eliminate surface seepage areas onsite and will affect offsite seeps from the Columbia aquifer.	This cap will allow approximately 2% of the rainfall to enter the fill materials. This is approximately 800 gpd.	Same as C1.
C4) SURFACE CAP MAIN FILL SUBSURFACE DRAINAGE IN THE COLUMBIA FORMATION (WITH AND WITHOUT A GROUND WATER BARRIER)	Capital 31.3 to 35.0 Million Present 32.8 to 69.0 Million	This alternative will significantly reduce the release of hazardous substances to the ground water beneath and around the site. It will also reduce surface discharges.	The existing landfill will remain in place; therefore, this alternative is to reduce or eliminate production of leachate coming from the landfills.	This alternative assumes the surface cap will meet RCRA standards. The subsurface drainage will be placed upgradient on the eastern and northern boundaries of the fill and will be constructed to allow gravity flow. Treatment should meet NPDES standards.	Space limitations between highways and fill materials will make the drain difficult to install. A design stage is necessary.

Alter ve Compo ts	Cost	Public Health Considerations	Environmental onsiderations	Technical Considerations	O r
C5) MAIN FILL SURFACE CAP, GROUND WATER PUMPING IN THE COLUMBIA FORMATION	**Capital** 16.2 Million **Present** 18.1 to 20.0 Million	Same as C4.	Same as C4.	A RCRA cap is assumed. Ground water pumping will be done upgradient on the eastern and northern boundaries.	The reliability of a this alternative for the long term is marginal.
C6) MAIN FILL SURFACE CAP, DIVERSION TRENCH	**Capital** 33 Million **Present** 39 to 71 Million	Same as C4.	Same as C4.	A RCRA cap is assumed and vented gases will be monitored. The diversion trench will be placed upgradient on the eastern and northern boundaries of the fill and will be constructed to allow gravity flow.	Same as C4.
C7) MAIN FILL EXCAVATE, RCRA LANDFILL ONSITE	**Capital** $61 Million **Present** $53 Million	Excavation will mitigate the source of ground water contamination and surface releases will be eliminated.	By removing the landfill, all environmental receptors will be protected when excavation is completed. Excavation will release gases from the landfill material.	The excavation can be done using conventional methods.	The estimated time for completion is 5 years
C8) MAIN FILL EXCAVTE, OFF-SITE DISPOSAL	**Capital** $61 Million **Present** $246 Million	Same as C7.	Same as C7.	Same as C7.	Implementability is highly questionable since there are very few facilities at this time and costs for hauling and disposal would be high.
C9) MAIN FILL EXCAVATE, ONSITE INCINERATION	**Capital** $106 to $164 Million **Present** $327 to $370 Million	Same as C7.	Same as C7.	Technical compliance with RCRA regulation must be met.	The large volume of wastes make this very costly and time consuming.
C10) MAIN FILL EXCAVATE, OFF-SITE INCINERATION	Not calculated.	Same as C7.	Same as C7.	Same as C7.	Use of an offsite commercial facility is unlikely at this time due to limited capacities and large backlogs.

Alternative Components	Costs	Public Health Considerations	Environmental Considerations	Technical Considerations	Other
D1) MANAGEMENT OF GROUND WATER PLUME; ONE PUMPING WELL AT LOCATION OF TEXACO REFINING AND MARKETING COMPANY WELL OR-6A	None	This will cause the contamination to spread in the UHZ of the Potomac. Concentrations of organic contaminants at the well are anticipaged to be very low levels but levels between the well and the site will be higher; probably high enough to pose a risk to human health if the water were used.	This alternative will cause the contaminant plume to spread.	Remediation of the UHZ is not confirmed by the RI. How much of the plume which will not be drawn to the production well is unknown. This alternative will require continous pumping for an extended period of time, possibly 20 to 30 years. Ground water use restrictions must be implemented.	The production well could mix the water with water from other Texcaco wells for use in their facilities.
D2) MANAGEMENT OF GROUND WATER PLUME TWO PUMPING WELLS FOR CONTAMINANT PLUME REMEDIATION AND WATER RESOURCE RECOVERY	Capital $1,458,200 Present $3,673,000	This alternative will stop further migration of the plume; will collect the plume for remediation.	This alternative will protect the ground water resources.	This alternative will take 20 to 35 years of fairly continuous pumping, collecting and treating. A design investigation is needed. Institutional controls will be necessary until plume is remediated.	Aquifer remediation is contingent on source control.
D3) GROUND WATER PLUME MANAGEMENT THREE PUMPING WELLS FOR THE MAIN LANDFILL	Capital $1,033,500 Present $2,740,000	Same as D2.	Same as D2.	Same as 19 except this alternative will take 40 to 100 years.	Same as D2.